METAL INDUSTRY

21 FEBRUARY 1958

Technology in Russia

MANY statistics have been published on the magnitude of Russian educational enterprise. Statistics are, however, capable of many interpretations and a judgment based on personal experience is much more valuable. One of the first impressions gained by Dr. I. G. Slater, Head of the Metallurgy Department, College of Technology, Birmingham, in a recent tour of Russia is that, at a relatively early age, it becomes clear to the Russian student that success in scholarship is an essential way to be accorded a position and status in society well above the ordinary man. For that reason competition for places at the higher institutes of learning is exceedingly fierce; thus, this year, at the Mendeliev Chemical Technological Institute, 1,500 candidates applied for the 600 available places.

At the higher technological institutes courses for a first degree are of five or five-and-a-half years' duration, with 36 hours or more of formal teaching and laboratory work per week. For second degrees three years of research are required with another three years for the highest degree of "Docent". Teachers of the highest calibre are attracted by the simple expedient of according the right pay and conditions for the job. Ample time is allowed all senior teaching staff for research and reflection, well illustrated by the fact that the ratio of teachers to students is of the order of 1:10. In one metallurgical institute a substantial proportion of the students' time is spent in the drawing office, the result being that even chemists and metallurgists are turned into quite reasonable draughtsmen, with the ability to design and lay out equipment and plant in a very competent manner.

A vital component in technological development in Russian industry is the very large number of research institutes that have been set up. They combine the functions of our research associations and government laboratories, together with some of the activities of our industrial research laboratories. Well staffed—at the Dnepropetroosk Iron and Steel Research Institute, for instance, the scientific staff numbers over 200—they have laboratory facilities and equipment of a very high standard. Many of the senior staff at these research institutes are visiting Professors at the local teaching institute, and form a permanent link between teaching, research and industry. Additionally, many of the senior staff in the teaching establishments spend two days per week in the research establishments. This combination of teaching and research dominates the whole of the technological progress and development in the local industry; a practice which could, with advantage, be adopted in this country.

One striking feature in Russian industry itself is the very high ratio of graduate staff employed, in some cases many times greater than that normal in British practice. Many, however, are employed on duties which in this country would be assigned to technicians, draughtsmen, and other skilled workers. Possibly this may be connected with the vast amount of design and development work in progress or with the limited availability of workers with traditional "know-how". On the other hand it may very well be that Russia has discovered the worthwhileness of using highly trained personnel, in apparently, by Western standards, subordinate capacities. Equipment in industry is a mixture of old and new. In one steel foundry, for instance, jolt rammers of 40 tons capacity vied with laborious hand moulding procedures. Incidentally, the same foundry possesses a vacuum holding pot, operating at a pressure of 3 mm Hg, and capable of dealing with a 20 ton ladle of steel or a 120 ton ingot. Skilled work and experience are rewarded by much higher premiums over the labourer's rate than are evident in this country; the scientist and technologist, for example, may well expect a rate some five to ten times (or even more) that of the labourer. The result is that science and technology attract the pick of youth.

Out of the MELTING POT

More Choice

PYROPHORIC alloys—"flints"—are invariably the first application of cerium to be mentioned. These cerium-containing pyrophoric alloys have proved very satisfactory in providing the collection of requirements to be met by such materials: resistance to atmospheric corrosion, suitable abrasion resistance to ensure a low rate of consumption, and, last but not least, the ability to yield sparks hot enough and lasting enough to bring about ignition of (in)flammable liquids or gases. However satisfactory an existing solution of some particular problem may be, it still seems unable to deter inventors from trying to improve upon it. There are several reasons for this unstoppable activity, including the remarks made by smokers irritated by the disfunction of their cigarette lighters. On a higher level, there is the fact that cerium belongs to the family of rare earth metals and cannot entirely escape some of the implications of this fact. Yet another reason must be sought in the appearance in recent years on the commercial stage of a number of metals which formerly were curiosities even in laboratories. It is only natural that they should have been examined by those concerned with the production of pyrophoric alloys from that particular point of view. Alternatively, pyrophoric alloys may have resulted as by-products of more general investigations of the compositions and properties of various possible alloys of these new arrivals. One such development or by-product is a composition including both zirconium (35 per cent) and titanium (30 per cent), with, in addition, 35 per cent lead. Another composition free of zirconium, and, therefore, for obvious reasons of greater commercial interest, is a pyrophoric alloy of titanium and lead. The lead content should not exceed 52 per cent, to avoid heterogeneity and segregation, and should not be less than 40 per cent to avoid excessive hardness. The alloys may also contain up to 25 per cent of antimony, and some of the lead may be replaced by tin, though at some expense of the ignition qualities. The alloys are prepared by melting a cold compacted mixture of the powdered metals in a pure graphite crucible, in a carbon-tube short-circuit furnace in an argon atmosphere.

Closer Link

SCIENTIFIC and technical periodicals might, with some advantage, consider taking a leaf (or rather a page or two) out of journals devoted to various sports, pastimes or hobbies, or even journals providing popular reading matter. Correctly chosen, such leaves or pages would show that all these journals acknowledge the existence of the novice and new reader, and thereafter proceed to help him. Journals devoted to sports, pastimes or hobbies all, from time to time, publish articles intended to help the novice on matters of elementary practice, choice and care of equipment, tools, etc. It says much for the tolerance of readers who are old hands at the particular game that they do not complain about the publication of such articles as a waste of their time. Alternatively, it suggests that they, too, read such articles and find them useful if only for "brushing up" purposes. By contrast, the scientific and technical press tends to assume that all its readers have graduated by way of training, study, experience, general textbooks, and the like, to a stage at which they are able to understand, appreciate and profit from the contents with little or no introductory help, and at which articles of an elementary nature would be of no use to them. Indeed, there may well exist the presumption that any such help might well be taken amiss as reflecting on the academic achievements and general or specialized erudition of the readers. While this risk could be avoided by a few words of introduction and explanation, the utility of the occasional simpler, more general or more comprehensive articles to prospective students, actual students, newcomers, and (sh!) the experts and the more narrow specialists still remains well worth while considering. One factor to be taken into account is the relation between periodical literature and contemporary textbooks and other reading matter in the same field. This relation has, in recent times, tended to grow more distant and, as a consequence of the growing complexity of the subjects, more complex. Its examination and subsequent modification by the above and other means should undoubtedly prove generally useful.

Mutual Interest

NOT so long ago the metallurgical world should have sat up and taken notice of the announcement from America of the production of a single crystal of what is normally a brittle ceramic material, namely, magnesium oxide, which, however, was successfully subjected to some degree of plastic deformation by bending (cf. this page, METAL INDUSTRY, 22 November, 1957, p. 434). Ductile pure ceramics, once out of the laboratory, would constitute a very much better answer to the high-duty problems, answers to which are at present being provided in terms of special alloys of advanced complexity and cost, or in terms of largely still empirically groping metal-ceramic materials. Apart from such direct and obvious considerations, the meagre hints regarding the way in which ductility of the magnesium oxide crystal was achieved should not be overlooked. They suggest, perhaps not quite unexpectedly, that ductility was connected with some particular surface characteristics, which, moreover, suffered rapid modification with a consequent loss of ductility on storing the crystal. This observation could be taken as the text for a by no means unnecessary discourse on the effect of surface characteristics and surface reactions (not forgetting chemical surface reactions) on the mechanical properties and behaviour of metals. Following such a discourse, the ensuing search for enlightenment could, in due course, lead to findings that would, perhaps, be usefully applicable to both ceramics and metals, in the shape of surface layers with a gradual transition from ceramic to ductile metal in the case of the former, and from metal to heat- and corrosion-resisting ceramic in the case of the latter. It is in the acquisition of knowledge and understanding along these lines that really satisfactory solutions are also likely to be found to the problems encountered with metal-ceramic mixtures (cermets) as at present constituted, solutions that will enable the transformation of these mixtures into what they should be ideally, namely, metal-ceramic compositions. Finally, consideration might be given to the possibility of sincerely flattering the achievement, however marginal, of ductility in a ceramic crystal, by imitation in the metallurgical field by the achievement of a high degree of elasticity in a metal crystal, and I do not mean a metal whisker.

Skimmer

MAGNESIUM DUST — FOUNDRY SAND — AIR SUPPLY

Dust Elimination in Metal Working

By A. E. WILLIAMS, Ph.D.

(*Concluded from* METAL INDUSTRY, 14 *February* 1958)

AS is well known, magnesium dust is a highly inflammable material, and in machining this metal some means of controlling the fine metallic particles created has to be adopted. One of the newest methods is to make use of a collector designed for this work; an example is shown in Fig. 4. The principle of the collector is that of a dynamic precipitator of the hydrostatic type, in which the metal particles are recovered by the use of an inverted S-shaped water curtain. The water curtain provides a safe and efficient method of controlling finely divided magnesium powder. An induced flow of air through a stationary impeller maintains the water curtain, the lower opening of the impeller being partly submerged in the water. Air, flowing through the impeller at high velocity, carries the water with it in a heavy turbulent sheet along the inner surface of a lower impeller blade at such speeds that it is projected across the passage and reverses direction to follow the curve of an upper blade, from which it is ejected as a thick curtain that blankets the clean air chamber. The air stream passes twice through this curtain of water, and the rapid changes in direction of flow cause the metal particles to penetrate the water film and become permanently trapped. Any entrained moisture in the cleaned air is removed by an eliminator, while the water in the reservoir is continually re-used, a small amount of make-up water being needed periodically.

[Courtesy Air Control Installations Ltd.

Fig. 4—Enclosed grilled workbenches with downward suction in a magnesium dressing shop; the installation is part of a group of twelve 2-station benches

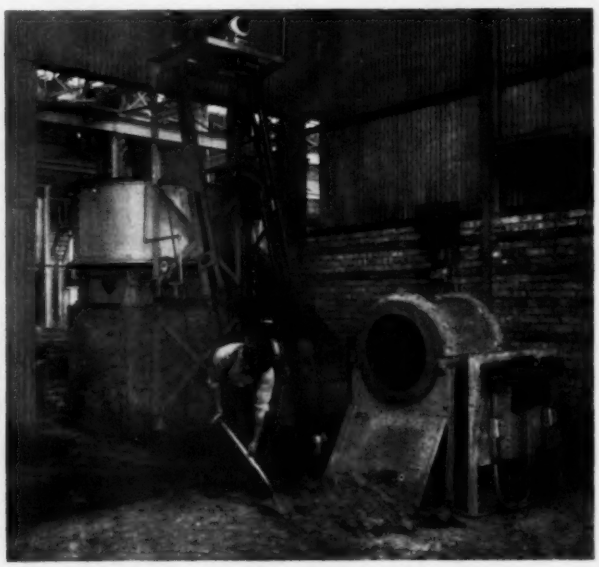
This type of collector was designed originally to collect magnesium dust from flexible shaft grinding, burring and buffing, but its application has been extended to portable grinding of castings and dies. A feature of such an installation is the grilled working surface or table, on which work on the magnesium workpiece may be done. Through this grill a suction effect is

Fig. 5—Hoods specially designed for grinding wheels, metal particles are carried away by suction as they are produced

[Courtesy American Air Filter Co. Inc.

Fig. 6—Facing sand plant unit which provides means for cleaning the sand prior to mixing and disintegrating

[Courtesy Pneulec Ltd.



[Courtesy Pneulec Ltd.

Fig. 7—Machine for conditioning backing sand and delivering it in a heap near the moulding machines

created by the collector, thus, instead of the usual collecting hood over the work station, one or more lamps may be fitted overhead, since as the dust is created it is sucked downward. As an alternative to a grilled workbench, it is sometimes possible almost totally to enclose the dust source and use an up-draught to convey the metal dust to the collector. An example of this is given in Fig. 5, where the grinding wheels are hooded and connected to branch ducts leading to the main ducting to the collector.

Foundry Sand

In foundry sand handling systems there are several points at which dust is created, and the use of exhaust ventilation and dust control equipment is often an advantage. With a normal foundry sand system, the material handling equipment generally includes shakeouts, conveyors, elevators (Fig. 6), screens, bins, and mixers that convey the sand to conditioning equipment (Fig. 7), and from that point to the moulder or core maker. The shakeout sand is the material in the sand cycle from the time of shakeout to the point where it is conditioned for re-use by the addition of water, bond, etc., and normally, exhaust ventilation is of value whether the sand is dry, or moist and steaming. Conditioned sand is the portion in the sand cycle from the conditioning unit to its end use. Containing more than 2 per cent moisture, handling this material produces no dust or steam, and exhaust ventilation is not usually needed. In the case of new sand being introduced into the sand system, if the material is of less than 2 per cent water content, and any appreciable proportion of fines is present, exhaust ventilation is advantageous.

Fig. 8—Exhausting foundry shakeout through a typical sidehood

[Courtesy Air Control Installations Ltd.

Apart from efficient design and good workmanship for exhaust ducts, hoods and housings, there are several features associated with dust removal in this field. Increased air requirements may be necessary to compensate for such abnormal conditions as excessive heat or moisture in the sand; mould explosions sometimes encountered in shaking out large moulds; strong cross draughts in the area of shakeouts and pouring stations utilizing side hoods for control.

In general, the capacity of the air-circulating and collection equipment should exceed the calculated capacity by at least 10 per cent to provide reserve capacity for unforeseen dust or smoke conditions. Cleaned air discharged from the collectors is normally released to atmosphere and not circulated to workrooms. The exhaust ducting should be of sufficient size to give conveying velocities to all branches and mains of not less than 3,500 ft/min. The use of a flared transformation piece between the hood or housing and exhaust branch is good practice, for this provides better air distribution for optimum control, lower pressure loss in the exhaust system, and the minimum pick-up of usable sand grains.

In most instances, the exhaust ducting is not less than 6 in. diameter, and the movement of somewhat higher air volumes necessary to eliminate the use of smaller ducts is balanced by a lower system resistance and improved distribution. In normal working, blast gate type dampers or baffles are employed in each branch duct to facilitate the balancing of the system and regulation of fines removal; after the correct position has been found for the baffles, these should be firmly fixed in that position. The use of baffles is nearly always advantageous, for these allow the different duct branches to carry the correct volume of air for a particular task; they may also be used to prevent excessive pick-up of usable sand or moulding material, while they permit distribution of the exhaust capacity to include additional dust points or future changes in the sand handling system.

Where smoke or other fumes are emitted, the use of a hood which is connected to the ducting is often a great help, for this enables the fumes to be caught and carried away before they can contaminate the workroom. In a melting furnace, for example, the hood may be fitted directly over the furnace, where the strong suction effect immediately absorbs the fumes from the melt. A furnace hood is essentially a shallow plenum chamber attached to

the roof ring of the furnace. Openings of appropriate proportion are provided to maintain an inward flow of air at points of fume escapement, such as over charging and slagging doors, pouring spout, and around electrode glands in the case of the electric furnace. This controlled and distributed exhaust volume prevents smoke, fumes and dust dispersion to the melting room and utilizes only a small fraction of the total exhaust volume that would be required to control these by-products if they were permitted to escape into the working atmosphere.

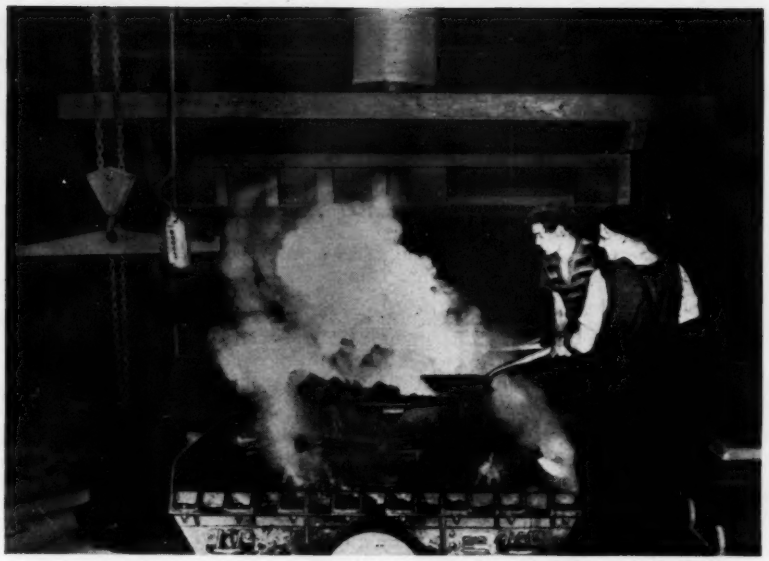
In some applications a side hood may be used. One such application is seen in Fig. 8, where foundry shakeout is being exhausted through a typical side hood. In dealing with foundry knock-outs, the side hood has proved to be an effective way of controlling fumes; Fig. 9 depicts a hood installed on a 6 ft. by 4 ft. foundry knock-out, in which it is clear that the fumes are being taken away via the hood as fast as they are created.

The type of collector used with the hoods may be of the wet type to cool and contract the hot gases collected from the hood. In the case of a melting furnace, the hot gases may be emitted for quite a considerable period and, in the absence of any cooling arrangements in the collector, the latter would become abnormally hot and cease to collect efficiently. Also, without adequate cooling equipment, a much larger collector and exhaust volume would be necessary to ensure sufficient air movement during peak temperature periods; one may compare this with air- and water-cooling of an automobile engine. A normal temperature is also needed in the collector to keep all moving parts at working temperatures. With some collectors a complete water curtain is employed; in others, a series of water sprays is used. The sprays maintain a flowing film of water on all collecting surfaces to provide a medium to trap the impinged dust particles, and to retard wear from abrasion by cushioning the impact of the dust particles on the metal surfaces. Where the dust is of no value, it is collected in a hopper as sludge and its disposal does not present any further dust problem.

Air Supply

In considering the installation of dust collecting plants, the problem of adequate air supply may arise, for it is obvious that air cannot be withdrawn at a rapid rate from workrooms unless an equivalent quantity can take its place. Exhaust systems of modern dust collectors create a considerable air turnover, and this has to be taken into account in some cases when calculating the heat requirements for a given work space. In only a few instances will the cubical content of a workroom be so vast in proportion to the amount of air withdrawn that the effect of the exhaust system can be neglected. Even if the heating system in a given workroom is adequate, as it often is in foundries and metal melting rooms, the make-up air rushing in through doors and windows creates draughts and can make working conditions very unpleasant, particularly in cold weather. Where the exhaust system is of appreciable capacity, it may be necessary to introduce heated air and distribute it without draughts, unless the cleaned air from the collector is circulated back to the workrooms. The recirculation of cleaned air is governed by certain engineering considerations, and also by the presence or otherwise of toxic constituents which have been collected with the dust.

Where toxic matter is absent and recirculation of air is considered practicable from the engineering viewpoint, an important economic advantage is obtained through the saving of heat, especially in winter months. If the collector is sited outside the buildings, there will be some heat losses due to exposed ducts and sheet metal surfaces. This source of heat loss can, however, be overcome to a large extent by lagging the outside metal surfaces. Air recirculation, therefore, is governed largely by the presence or absence of toxic material in the air after passing through the collector. Where this is present an air supply may have to be provided, via an air heater, to maintain the desired temperature in the workrooms.



[*Courtesy American Air Filter Co. Inc.*

Fig. 9—Fumes from a 6 ft. by 4 ft. foundry knock-out are continuously taken away by the adjacent suction hood

Readers' Digest

COPPER COMPOUNDS

"Gmelin's Handbuch der Anorganischen Chemie." (*System No.* 60. *Copper, Part B* 1). *Published by Verlag Chemie G.m.b.H., Weinheim/Bergstr, Berlin. Pp. xxvii*+624. *Price DM.*349.

DEVOTED to the compounds of copper, this new Gmelin volume follows the arrangement of the Gmelin classification system. Following the material on the hydrides, the present volume treats the compounds with oxygen, nitrogen, the halogens, sulphur, selenium, and tellurium. Emphasis is placed on important copper compounds such as the copper azides, the oxides—which are dealt with in connection with the well-explored copper-oxygen system — copper hydroxide, nitrate, chloride, and sulphate. Among this material the compounds of monovalent copper are prominent, particularly the oxide and sulphide (Cu_2O, Cu_2S) and the halides. Other important compounds treated in detail are the basic copper(II) salts of the type $\left[Cu\left(\begin{smallmatrix}-OH\\-OH\end{smallmatrix}\!>\!Cu\right)_2\right]X_2$, of which the chloride (atacamite) with its well-known lattice structure is a typical example.

Many of the compounds dealt with in this volume occur naturally as minerals. In contrast to the procedure followed formerly, the properties of these compounds are presented together with those of the synthetically derived salts.

Most of the copper(I) and copper(II) salts form numerous addition compounds with inorganic and organic substances, thus emphasizing the tendency of copper to form complexes. The material dealing with complex compounds will be completed in the B 2 issue, which will conclude the presentation of copper compounds.

Products and Processes

TRENDS IN THE DEVELOPMENT, APPLICATION, PROCESSING, DESIGN AND WORKING OF NON-FERROUS METALS AND THEIR PRODUCTS

Crucible Melting

A SELF-CONTAINED oil-fired crucible furnace, requiring no installation work other than coupling to electric power and fuel oil supplies, has been introduced by Norris Equipment and Construction Limited, 58 Queens Road, Bristol, 8.

The standard unit comprises a refractory firebrick-lined furnace complete with oil burner, motor-driven secondary air fan with starter mounted on a supporting framework, 8 ft. of flexible air hose to connect the fan and burner, 8 ft. of oil pipe, and a 2 gal. constant level tank fitted with ball valve and stop tap.

The furnace has a copper melting capacity of 150-200 lb. and will melt a charge of 150 lb. of gunmetal from cold in 50 min., the second heat melting time for the same charge being 25 min. With a 200 lb. charge the melting times are 60 min. and 30 min. respectively. Oil consumption is 3·5 gal/hr.

The furnace casing is cast in one piece with walls $\frac{5}{8}$ in. thick, and is lined with pre-cast sectional refractory firebricks designed to ensure that relining can be carried out by relatively unskilled labour.

The lid of the furnace is very conveniently carried on four rollers, and is so designed that it will pivot to expose its underside so that repairs of the firebrick lining can be quickly carried out. "C"-shaped crucibles should be used in conjunction with the furnace.

The burner is of the low air pressure type, and is designed to be easily dismantled without disturbing any pipe joints. By unscrewing the withdrawal nut the whole inner assembly is forced out, leaving the body in position with the oil pipes and air pipes still attached to it. There are no moving parts in the oil burner to wear or get out of adjustment, so that maintenance work is kept at the minimum. If required, remote controls can be fitted to the burner.

Pretreatment in Hot Dip Aluminizing

IN their pilot plant for the continuous production of hot dip aluminized steel from strip up to 4 in. wide, or from wire, the British Iron and Steel Research Association initially prevented the formation of an oxide film on the surface by treating the steel with copper sulphate, but the latest pretreatment method calls for the continuous application of a thin film of glycerine in methylated spirit to the surface of the steel just before it enters the molten aluminium bath. Material so produced has been examined for corrosion resistance and found to give effective protection against scaling of the mild steel base metal at temperatures up to 800°C.; it can thus replace stainless steel for certain applications.

Semi-Automatic Welding

SEMI-AUTOMATIC equipment for shielded inert gas metal-arc welding has been developed by Quasi-Arc Limited, of Bilston, Staffs. Known as the "Lynx," the equipment offers many new features, prominent among which are the following:—

A welding rectifier which is self-contained, having control of all the services required for the process—welding current, wire feed, gas glow and water cooling.

A light and portable wire feed and control unit which the welder, unaided, can readily re-position around large fabrications, and which he can easily part into two assemblies for carrying over longer distances.

Motorized remote wire feed speed control.

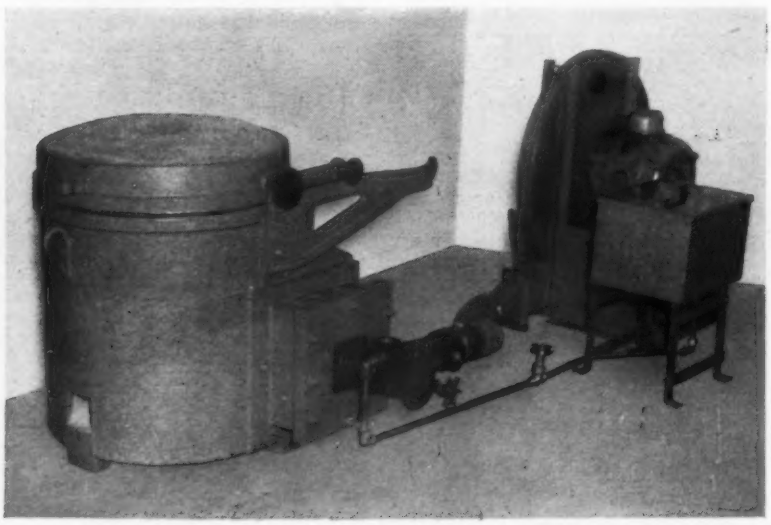
A choice of water-cooled or air-cooled guns, which are readily interchangeable without any modification of the equipment.

The complete equipment consists of three basic items:—(a) The welding rectifier; (b) the wire feed and control unit; (c) the welding gun, either water-cooled or air-cooled.

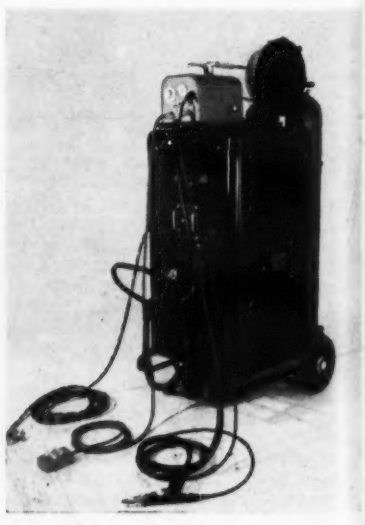
The welding rectifier is a specially-developed power source for this particular process, and consists essentially of a combined transformer and selenium plate metal rectifier. The wire feed and control unit embodies a totally-enclosed spindle assembly for the wire reel, the feed rolls and the wire feed motor. The unit weighs only 40 lb. Motorized remote control of the wire feed speed is provided, so that all adjustments are made without loss of time. Wire feed speed range is 60 to 600 in/min., and the controls can be operated with the gloved hand. The control circuits operate at a safe 24 V. A.C.

The machine can be used with a water-cooled gun for

Oil-fired crucible furnace and forced draught fan unit by Norris Equipment and Supplies Limited



Quasi-Arc "Lynx" carriage unit and rectifier



currents up to 600 amp., or with an air-cooled gun for currents up to 300 amp. (250 amp. continuous). The water-cooled gun incorporates a water-supply failure device and this protection cannot, therefore, be left out of circuit when the gun is fitted to the machine. This device automatically resets when the water supply is restored; there are no fuses to replace. The electrical connections to the gun operate at 24 V. A.C.

The "Lynx" equipment is designed for welding aluminium and its alloys, copper and its alloys, corrosion-resisting steels, mild steel, etc. Welding speeds are high; in aluminium, using $\frac{1}{16}$ in. wire at a current of 245 amp., a $\frac{1}{4}$ in. horizontal-vertical fillet weld can be deposited at an overall welding speed of 18 in/min.

Ultrasonic Cleaning

APPLICATIONS for ultrasonic cleaning are rapidly increasing, and a very recent one has been found in the ball and roller bearing industry. Schoeller and Company, of Frankfurt (whose U.K. representatives are Roto-Finish Limited, Mark Road, Hemel Hempstead, Herts.), specialists in developing and manufacturing ultrasonic equipment, have recently supplied automatic ultrasonic cleaning machines for cleaning assembled ball and roller bearing races.

These automatic machines can clean 5,000 bearing assemblies of 30 mm. diameter per 8 hr. shift. They can be set for cleaning bearing races in sizes from 25 mm. to 75 mm. in diameter. Automatic machines can also be supplied for other sizes.

The machines have two ultrasonic cleaning stages and a device for revolving the bearing races during the cleaning operation. The cleaning fluid used is petroleum; filtering apparatus and a circulation pump are built-in.

Vacuum Melting

REFRACTORY metals such as molybdenum and tungsten requiring a high melting temperature may be melted in vacuum furnaces using a direct arc as the heat source and a water-cooled copper hearth as the crucible material. Using this arrangement, specimen buttons of tungsten and molybdenum can be prepared in a low-pressure argon atmosphere. Reactive metals such as titanium and zirconium can conveniently be melted and cast in a vacuum using the consumable electrode technique, where the material being melted forms the actual electrode. The operation is both quick and effective, and in a laboratory-scale arc furnace, recently introduced by Edwards High Vacuum Ltd., Manor Royal, Crawley, Sussex, ingots $1\frac{3}{4}$ in. in dia. and $10\frac{1}{2}$ in. long can be cast.

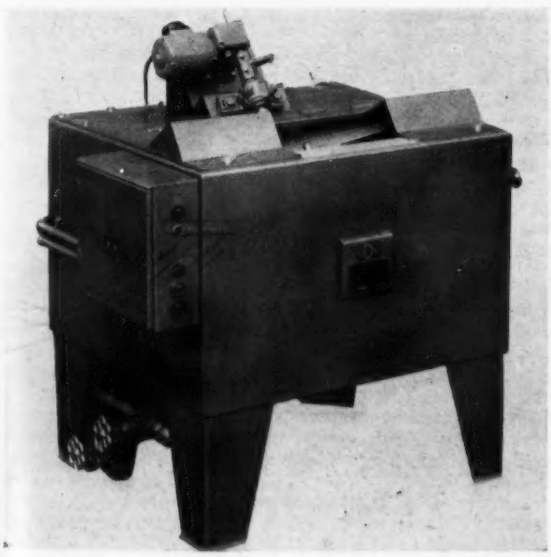
The furnace is a compact and versatile unit, capable of being used for both consumable and non-consumable electrode work. The dual-purpose version of the furnace is pumped by a 9B3 booster vapour pump, backed by a 1SC450 rotary pump displacing 15 ft³/min. These unique booster pumps are specially designed for metallurgical processes where large-scale degassing occurs during heating and melting. An outstanding feature of the pump is its ability to work against backing pressures as high as 3 mm. Hg, thus enabling it to be used in the pumping cycle when the efficiency of the rotary pump is still high. The unbaffled speed of the 9B3 is 900 L/sec. at working pressures as low as 0·004 mm. Hg, and it has a maximum gas throughput of 18,000 litre microns/sec.

If required solely for non-consumable electrode operation, the high-speed booster pumping system is not necessary, as the furnace will operate in a low-pressure argon atmosphere. To maintain purity in melting, however, a smaller pumping system is provided, consisting of a Model 203 oil diffusion pump capable of attaining an ultimate vacuum of 5×10^{-6} and having an unbaffled speed of 80 L/sec. This is backed by a "Speedivac" 1SC150 rotary pump, displacing 5 ft³/min. Vacuum measurement in the backing line is provided by a B2 Pirani type vacuum gauge, which can also be used as a leak detection unit using the hydrogen/Pirani method.

The furnace is normally intended to be operated from a 600 amp. dual continuous-control arc welding generator. The plant is completely self-contained and occupies a floor space of 4 ft. by 4 ft., with a height of 9 ft. Vacuum gauges and other electrical instruments are built into a separate pedestal cabinet.

Right: Close-up view of the body of the Edwards' vacuum and argon arc furnace, showing the arrangement for operating with consumable electrode

Below: Automatic ultrasonic cleaning plant for the cleaning of assembled ball and roller bearing races



Men and Metals

It has been announced by Northern Aluminium Company Limited that **Mr. J. H. Mayes,** general sales manager, has been appointed to the board of directors. Mr. Mayes joined the company in 1934 in the technical section of the Banbury works. Three years later he transferred to sales, and was head of that division until 1952,

when he took up the position of castings and forgings sales manager. In 1953 he was appointed export sales manager, and in 1956 became assistant general sales manager. He was appointed to his present position as head of the sales department in April last year.

The appointment has been announced of **Dr. Brian Baldwin** to be Assistant Chief Metallurgist of the Steel Division of The Steel Company of Wales Limited. Dr. Baldwin joined the company in July of last year as

Research Metallurgist, Blast Furnaces. He had previously been engaged on research into iron making at the London laboratories of the British Iron and Steel Research Association, and his work for the association took him to iron and steel plants in all parts of the country. He was educated at Brighton Technical College and the Imperial College of Science and Technology, London, where he obtained his B.Sc. and Ph.D. degrees.

A new appointment just announced by the United Kingdom Atomic Energy Authority is that of **Mr. H. A. C. McKay,** of the Chemistry Division, Atomic Energy Research Establishment at Harwell, who is to be Director of the Baghdad Pact Nuclear Training Centre from July next. Mr. McKay was Beit Memorial Fellow at Imperial College, London, in 1937, and a demonstrator at King's College, London, in 1939. Following the war, in which he served in the Royal Navy, Mr. McKay was appointed a senior scientific officer in the Chemistry Division at Harwell, and was appointed group leader of the heavy element group in the division in 1954. He specializes in solution chemistry.

News from the George Cohen 600 Group is to the effect that **Mr. N. G. P. Boswood,** secretary of the group, has been appointed a director of Colchester Lathe Company, a member of the group.

An announcement by the Deritend Stamping Company Limited is to the effect that **Col. J. W. Danielsen,** D.S.O., T.D., D.L., M.I.Mech.E., J.P., will retire as chairman of the company at the end of this month but will remain a member of the board. He will be succeeded by **Mr. C. W. Perry,** at present deputy chairman.

A deputy general manager of the company, **Mr. George C. Fairbanks** has been appointed a director of Elliott Brothers (London) Limited. Mr. Fairbanks joined the company in 1930.

A director of The British Oxygen Company, **Mr. J. Strong** has relinquished his appointment as chairman of Quasi-Arc Limited, on being appointed chief executive director of British Oxygen Gases Limited.

Technical representative, Overseas Division of Expandite Limited, **Mr. L. H. E. Jones** is shortly to make a tour of Scandinavia. During his tour he will visit his company's distributors and projects in which Expandite materials are being used.

Many plumbing and education personalities were among the fifty or so guests who attended an informal reception and cocktail party arranged by the Plumbing Trades National Apprenticeship Council to celebrate the tenth year of their scholarships, which are administered by a Material Producers' Awards Council. Following an address of welcome to the guests by **Dr. Maurice Cook,** President of the Aluminium Development Association, the awards were presented to the scholarship winners by the Master of the Worshipful Company of Plumbers, **Alderman W. R. Cowen,** O.B.E., J.P. The winners of the 1957 scholarships were **Mr. D. A. Blundell, Mr. C. W. J. Lear, Mr. C. W. Helley, Mr. A. Holley, Mr. G. S. Wilson,** and **Mr. D. B. Halley.** Alderman Cowen also presented the silver medal and five guinea prize of the Institute of Plumbing to **Mr. A. R. Bradstreet,** who had obtained the highest number of marks in the 1957 examinations of the City and Guilds of London Institute. The following organizations constitute the Material Producers' Awards Council: Aluminium Development Assocation; British Malleable Tube Fittings Association; British Non-Ferrous Metals Federation; British Plastics Federation; Copper Cylinder and Boiler Manufacturers; Copper Development Association; Galvanized Tank Manufacturers' Association; Gas List Tube Association; Lead Development Association; Tin Research Institute; and The Zinc Development Association.

Chairman and managing director of Frederick Braby and Company Ltd., **Mr. F. C. Braby,** M.C., D.L., has been appointed a member and chairman of the Industrial Coal Consumers' Council. Mr. Braby is President of the Engineering and Allied Employers' National Federation, and honorary treasurer of the British Non-Ferrous Metals Research Association.

Recent news from the United States is to the effect that **Mr. S. W. K. Morgan,** B.Sc., A.R.S.M., has been given an award for the "Technical Achievement of 1957" by the U.S. technical journal *Mining World.* Mr. Morgan is director of research at the Avonmouth works of Imperial Smelting Corporation Limited, and the award has been given in connection with his outstanding contribution to the minerals industry during the past year.

In succession to **Mr. L. Rotheram,** who was recently appointed to the Central Electricity Generating Board, the United Kingdom Atomic Energy Authority have appointed **Dr. H. Kronberger,** O.B.E., F.Inst.P., to be director of research and development in the Authority's industrial group.

STANDARD SPECIFICATIONS

Diamond Dies for Wire Drawing (*B.S.*2946:1958). *Price* 4*s.*

RESULTING from ten years' experience in the application of the previous edition, and from tests conducted by the British Diamond Die Federation, this revised standard now includes requirements for both reinforced and non-reinforced dies. It supersedes the existing standards for these products (B.S.1393 and B.S.1168 respectively).

The specification contains clauses on quality of die stones, bore of the die, mounting, casing, size, assembly of die, and marking.

One of four appendices contains a useful *aide memoire* for purchasers — a summary of the information recommended to be supplied with an enquiry or order.

Copies of the above-mentioned standard may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

Finishing Supplement

Effluent Problems

By F. WILD, A.I.M.
(*R. Cruickshank Ltd.*)

III—PLANT LAYOUT AND CONSTRUCTION

(*Concluded from* METAL INDUSTRY, 7 *February*, 1958)

THERE are numerous suggested methods for effluent disposal, such as evaporation to dryness, "ponding" and allowing to seep away, dilution with non-toxic effluent, and the use of ion exchange resins, but the two most satisfactory schemes in use are: (1) The batch chemical treatment process; (2) the continuous chemical treatment process.

In the batch process, the effluent is allowed to run, or is pumped, into treatment tanks, the necessary chemicals are added, and the effluent left there until the reactions are completed. In the meantime, the untreated effluent is run into other treatment tanks to await treatment. After treatment, the effluent is pumped out and the tank is ready for the next batch.

This scheme occupies much more space and plant, such as pumps, than the continuous system, but it is more suitable for concentrated effluents such as are met with in the periodic disposal of cleaning or plating solutions. The other advantage this scheme possesses is one of positive control over the final treated effluent.

The continuous process can be applied by ion exchange, or by controlled addition of chemicals to the effluent.

In the ion exchange method, the effluent is pumped through cationic and anionic exchange resins, which remove both metals and acid radicals, i.e. cyanides, chromates, etc. The treated effluent from this process can be recirculated, being, in some cases, purer than the original clean water supply. The resins are subsequently treated to remove the toxic materials as concentrates, which are much easier to treat chemically.

This type of plant has the disadvantage of high initial cost, but it is a most effective method of treatment. It has a disadvantage in the processing of effluent containing organic matter, such as brighteners, in that the effluent must be pretreated with carbon to remove organics.

In the continuous system used in this country, the separated effluents are passed through continuous flow pits to which are added the treatment chemicals, either as solution or slurry from storage tanks.

As previously mentioned, chromium as chromates may be treated with ferrous sulphate, sulphur dioxide or sulphites.

If ferrous sulphate is used, this is generally added by allowing water to run over ferrous sulphate crystals contained in a tank, and the resulting solution fed into the chromate drain or treatment tank. When sulphur dioxide is used, it is taken from cylinders in a sulphur dioxide feeder plant.

If the chromate content of the effluent is rather erratic, the use of a holding or balancing tank helps to even out the contamination so that excess of chromate or treatment chemicals do not occur in the treated effluent.

The reaction pit or tank should be arranged so that the solution passing through takes the longest route. This is arranged by baffles and weirs, and ensures good mixing and correct treatment time. The pit should be of sufficient size to allow at least 30 min., i.e. if the flow rate is 600 gal/hr., the pit should hold about 300 gal. of solution.

After this reduction, the solution passes to the next pit, where lime or other alkali is added to neutralize the acid and to precipitate chromium salts or iron and chromium salts. The solution then passes to the settling pit, where a time of 2-4 hr. should be allowed for settling out of insoluble matter as sludges.

In some shops it may be convenient to add the treatment chemicals to the shop drain but, at the same time, a reaction, a neutralizing and a settling pit should be provided.

Using the same scheme, non-cyanide metal and acid or alkali wastes can be added at the neutralizing pit, and the same settling pit used.

Cyanide wastes are rendered alkaline, if necessary, by the addition of caustic soda or lime slurry, the caustic soda being added from a solution storage tank, or the lime slurry from an air- or mechanically-agitated slurry tank. Chlorine may then be added as a solution with caustic soda, the general principle being to pump some of the effluent from the pit through the chlorinator, injecting caustic soda solution into it before passing through the chlorinator and back to the reaction pit. Chlorination equipment is expensive and is only justified on a large plant.

For the smaller type of effluent disposal plant, the use of sodium hypochlorite solution or bleaching powder is recommended, the solution or bleaching powder slurry being added from a storage tank.

As in the chromate reduction process, the use of a balancing tank and baffle type reactor tank is recommended, with sufficient volume to give a reaction time of about 45 min.

At the end of the reaction time, sodium thiosulphate solution is added to remove excess chlorine, and the treated solution allowed to mix with the treated chromate and acid alkali metal effluents in the neutralizing tank.

The treated cyanide effluent, which is alkaline, helps to neutralize excess acid in the treated chromate effluent and precipitates all the metal salts as insolubles. The addition of extra alkali material may be necessary if the acid content is high. This tank should be agitated by air or by a mechanical paddle, to ensure good mixing and effective neutralization.

After treatment here, the solution, together with the suspended matter, passes to the settling pit, where it is allowed to settle out from 2 to 4 hr.

Settling out can be accelerated by the addition of "Aluminoferric" (aluminium sulphate), which is added as solution to the neutralizing pit. The "Aluminoferric" is purchased in block form and the solution is prepared simply by allowing water to run over it in a tank having fitted racks to hold the blocks of material. If convenient, the "Aluminoferric" solution may be added to the chromate effluent.

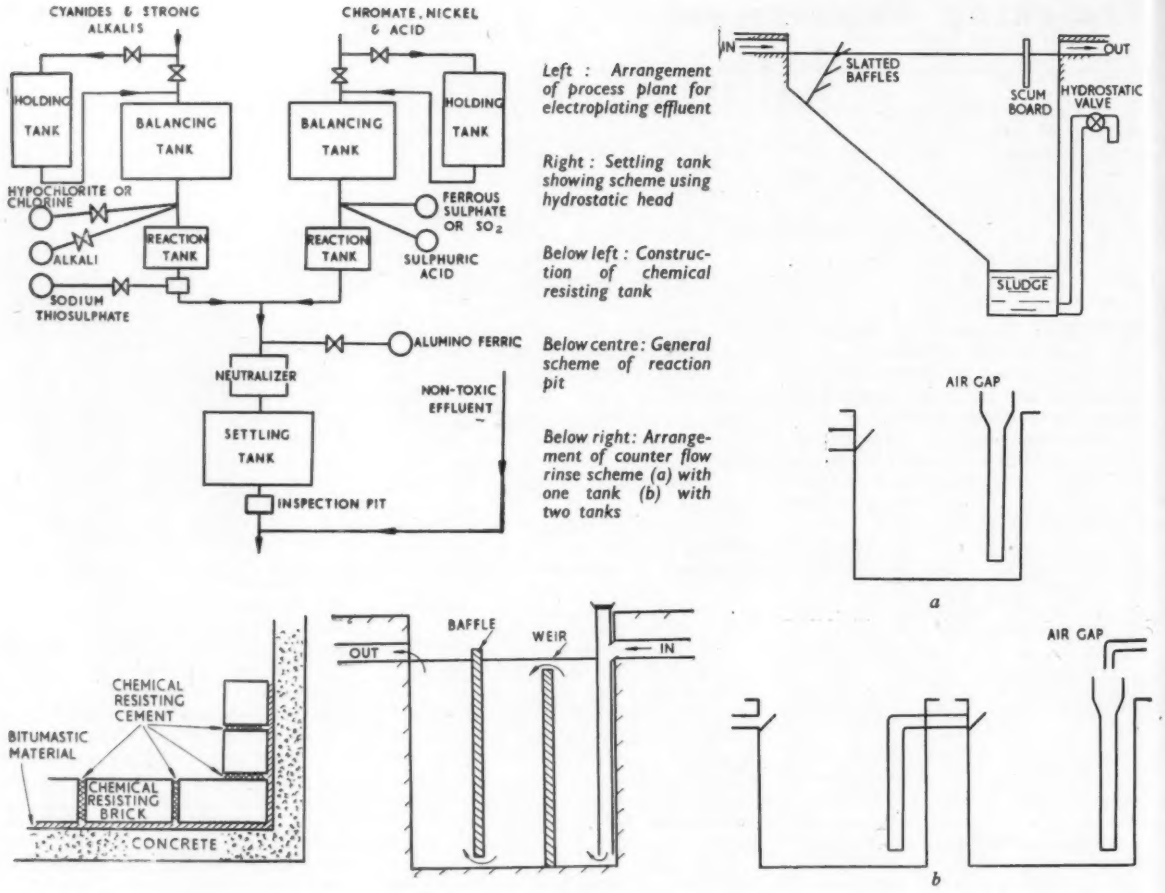
Another material used in conjunction with "Aluminoferric" is chlorinated silica, which again accelerates flocculation and settling time.

Automatic Equipment

This type of equipment is available in the form of *p*H controllers, operating proportioning pumps which add necessary lime, caustic soda or acid, but where these are used arrangements must be made for a holding or balancing tank, so that variations in the effluent are levelled out somewhat. Where chromates are reduced by sulphur dioxide or other reducing agent, controllers operating from reduction - oxidation electrodes are used. For chlorination of cyanides no suitable control equipment is available, and one must rely on chemical tests.

This type of equipment is very expensive and is only justified on large installations.

Mechanized feeding equipment may



Left : Arrangement of process plant for electroplating effluent

Right : Settling tank showing scheme using hydrostatic head

Below left : Construction of chemical resisting tank

Below centre: General scheme of reaction pit

Below right: Arrangement of counter flow rinse scheme (a) with one tank (b) with two tanks

include a variety of plant, such as lime hoppers, which deliver a fixed quantity of lime into a slurry tank from time to time, sulphur dioxide and chlorinating equipment, but in all cases the use of expensive automatic equipment should be confined to larger plant installations.

Plant Construction

Where conditions are such that the building of pits is necessary, the pits should be constructed of acid- or alkali-resisting brick. The general construction of a pit consists of: (a) a concrete pit; (b) a bitumastic liner; (c) the brick tank, cemented with suitable chemical-resisting cement.

There are several proprietary cements available, and manufacturers give full details as to their use.

Entry of the effluent to a pit should be at the bottom, this being generally achieved by a pipe of suitable material, generally glazed earthenware, running down inside the brick pit. Exit is by overflow on the opposite side of the pit, and between the two there may be baffles and weirs, depending upon the pit size.

Where two effluents, or an effluent and a reagent, are to be intimately mixed, recourse is sometimes made to the use of a sloping weir having protrusions over its face, so that mixing occurs as the two effluents run down the face. Settling pits may be plain, rectangular pits from which the sludge is removed by a scoop, or on larger plants they may be hopper shaped, the sludge being removed by means of a hydrostatic head, or sludge pump.

Practical Methods

While the foregoing deals with the ideal effluent disposal plant and methods, economic and space considerations considerably restrict the plant available in small manufacturing plants, and other methods of reducing the problem must be looked for.

When one considers that the majority of chemicals in any plant carrying out electroplating processes eventually find their way into the drain, and thence to the sewer, and that further expenditure is incurred in the use of chemicals to treat them in the effluent, it will be seen that, to use an old adage, "prevention is better than cure." As well as being better, it is cheaper in both treatment chemicals and plant to prevent the process chemicals going into effluent than to allow them into it and then try to treat them.

There would appear to be differing schools of thought on this subject, one view being to restrict the loss of chemicals and the other to dilute the effluent with large volumes of water.

The latter method may work satisfactorily where there is only a small amount of toxic material and several processes producing non-toxic effluent. It is expensive in water consumption, and if a charge for acceptance is made can be more expensive still.

The various methods which can be employed are, to a large extent, controlled by the processes and types of work, and in existing shops, where the layout cannot be altered, prevention would seem to be the only method, as mixed effluents are almost impossible to treat except by expensive demineralization plant.

There are a number of suggested methods of economy in chemicals and water. These include: use of drag-outs; the use of counter-flow; use of spray or fog rinses; use of mist sprays over solutions where the evaporation rate is high, thus rinsing the plating solution back into the process tank; attention to jigging methods to reduce drag-out losses; use of drainage racks and drip trays, with the training of operators to drain work and rotation of plating barrels over the solution tank; use of air jets on automatic plant to remove solution from cup-shaped articles; use of wetting agents to help in drainage, where suitable; design of

rinses to obtain maximum efficiency of rinse water.

In the drag-out method, the plated articles are dipped in a static rinse and the solution in the rinse tank is used to replace daily evaporation of the plating solution.

If the amount of drag-out used daily for replacement of plating solution is represented by E, and the average daily carry-over by D, the drag-out solution will build up to a concentration represented by $\frac{D}{D+E}$ of the concentration of the plating solution.

Using this method, the British Non-Ferrous Metals Research Association, in their publication, report that the fraction $\frac{D}{D+E}$ on an automatic plant was found to be 1/9, thus reducing the amount of chemicals lost in rinse water to one-ninth of the original figure. For hot solutions where E is high, the resulting drag-out concentration would be much lower, with a higher saving in chemicals.

In the counter flow rinse scheme, where space permits the use of it, two or more tanks are employed and the rinse water enters the tank furthest from the process tank, and thence from one rinse to the next. This scheme is generally used where drag-out solution cannot be returned to the plating tank and has the advantage that, although it does not save chemicals, it concentrates the effluent into a more easily treated form, thus saving water and reducing the size of the treatment plant.

If C_1 = the concentration of salts in solution carried over into the running water rinse

C_2 = the average concentration of solutions in the running rinse at equilibrium

d = volume of drag-out per unit area of work

f = volume of water used in the running rinse per unit area of work

then

$$\frac{f}{d} = \frac{C_1}{C_2}$$

provided the solution and rinse water are properly mixed.

If a counter flow system of rinsing is employed, then

$$C_2 = \left(\frac{d}{f}\right)^n C_1$$

where n represents the number of rinse tanks. Thus, for one rinse tank the volume of rinse water to maintain a given concentration would be

$$f = d \left(\frac{C_1}{C_2}\right)$$

and for two rinse tanks

$$f = d \sqrt{\frac{C_1}{C_2}}$$

To take an example, if a given plating solution contained 10,000 p.p.m. of metal salt, and the desired concentration of the final rinse water was 10 p.p.m.,

using one tank,

$$f = \left(\frac{10{,}000}{10}\right) d$$
$$= 1{,}000\ d$$

Using two tanks,

$$f = \left(\sqrt{\frac{10{,}000}{10}}\right) d$$
$$= 31{\cdot}6\ d$$

thus the amount of water used would be $\frac{31{\cdot}6}{1{,}000}$ of that using one tank only.

Using three tanks, the fraction would be $\frac{10}{1{,}000}$ or $\frac{1}{100}$ the amount of water.

Spray or fog rinses do not reduce the chemicals in the effluent, but concentrate the effluent to a more easily treated form, thus reducing water consumption and, consequently, the size of the treatment plant.

Mist sprays are used in the U.S.A. on automatic plants where evaporation losses of plating solution permit components to be rinsed in this manner, the rinse falling back into the plating solution. Where applicable, the saving in water and chemicals is considerable.

The savings from the use of jigging methods, drainage racks and drip trays for solution recovery are considerable, but the economics of labour cost should be borne in mind.

Wetting agents have been used in chromium plating solutions to reduce spray losses but, at the same time, they reduce drag-out losses, as the film of solution carried over on articles is thinner, due to lower surface tension.

In the design of rinses, the entry and exit of water should be so arranged that the water passes through the whole swill, and not, as in many cases, across the surface of the rinse, straight into the outlet drain. This can be effected by ensuring that inlet and outlet are on diametrically opposite sides or corners of the tank, and that the incoming water is fed to the bottom of the tank. Feeding of water to the bottom of the tank can be done by means of a corner gusset, or by a pipe leading down inside the tank, but it should be remembered that in order to comply with Water Board regulations, there should be an air break in the pipe so that water cannot be siphoned back into the main.

Other methods of reducing the problem are:

(1) The use of piped drains for segregation of effluent into more easily treated groups where conditions do not permit re-laying out of the plant.

(2) The use of shop drains for the treatment of toxic materials, and the addition of the treatment chemicals direct into the drain. This can only be applied where the effluent is of low volume, unmixed with other unsuitable effluent, and the drain is of reasonable length. The fitting of a weir inside a floor drain to increase the volume will help when this type of treatment is used.

(3) The use of acid and alkali wastes in chromate reduction and cyanide oxidation processes. In the former, an acid solution is necessary for reaction, and in the latter an alkaline solution, and full use should be made of any chemicals which are available in the effluent.

(4) Self-neutralization of acid and alkali wastes where permissible.

(5) The sale or free disposal of used chromic acid solutions to the chrome leather industry.

(6) The sale or free disposal of nickel stripping solutions to companies who will recover the nickel.

(7) The addition of chemicals to rinse waters where suitable. Additions of sodium sulphite and hydrosulphite have been successfully made to chromate rinse waters, reducing the chromate content. The chromium salts are subsequently precipitated by alkali, but the acceptance tolerance for insoluble chromium salts is much higher than for chromates in solution.

(8) The electrolytic recovery of copper and sulphuric acid from copper and brass pickling solutions, with a reduction in effluent disposal, as well as a considerable material saving. In one plant in this country the saving in material alone, using this recovery process, is £25-£30 per day.

Finally, one other matter which is often forgotten is the contamination of storm water from roofs, due to chromic acid deposits from fume extractors.

The spray from chromic acid baths can be reduced in several ways, of which the two chief methods are the use of surface tension reducers and glass or plastic floats. These reduce spray considerably, thus lessening deposits on roofs around fume extraction outlets.

Buffing Compounds

LIQUID buffing compounds can be more economical than bars, according to an article in *Plating*. Even without the problem of nubbins, which must be remelted and reprocessed, liquid buffing compounds will often save from one-third to one-half of the compound cost on a particular machine. Due to the fact that water is commonly used as a vehicle, the tendency is to keep the buffs cooler and increase the buff life. It is not uncommon to achieve buff life two to three times that attained with bar.

Due to less shutdown, more hours of production can be obtained from the machines. Ten to twenty per cent more production is not uncommon, and in special cases the improvement is greater.

Easier cleaning is brought about by substitution of this lower cost cleaning method, and a longer storage time is permissible before cleaning in the plating cycle.

RECENT ACTIVITIES OF HOT DIP GALVANIZERS ASSOCIATION

Productivity in Galvanizing

DESPITE many technical improvements, the few, and, in some ways, simple processes involved in galvanizing have not fundamentally changed since their inception. In contrast, the industry has made great advances in the field of productivity, in plant layout, in materials handling methods and equipment, and in the more efficient use of its plant and personnel.

This has largely come about through the activities and technical work of the Hot Dip Galvanizers Association, which include a productivity service for its members. Although it is not always possible to measure in precise terms the results of such work, a few examples will show how firms in the industry are benefiting from it:—

Following the implementation of recommendations made by the service, one company recently reported that a staff of 74 (66 per cent of the original total) had exceeded the previous record production by nearly 45 per cent.

Another company in which the weekly output, before and during the period of investigation, averaged 265 tons from four galvanizing baths, has now produced over 400 tons in one week from three baths.

Six months after discussing the report of an investigation carried out in the galvanizing department of a foundry, the management reported an increase in production of over 40 per cent without any increase in the galvanizing teams.

The productivity service, which is conducted by two fully qualified industrial engineers, carries out work study investigations in members' firms, prepares publications on various aspects of productivity, arranges training courses and conferences, and provides films and an advisory information service.

Work Study

Work study investigations and the information given in reply to enquiries, form the backbone of the productivity service and occupy most of the time of the industrial engineers engaged on it. Studies have already been carried out in 22 galvanizing works, and detailed reports prepared and discussed with the managements concerned. Over 400 recommendations have been made in the reports; they have covered immediate improvements and others which need long-term planning. An interesting feature of these investigations has been the use of time-lapse photography for detailed study, using equipment developed by the Association's engineers.

Special work study techniques can improve team work and complex operations in just the same way as in repetitive and simple operations. The film "Work Study—Its Application to Teamwork," made with the co-operation of the British Productivity Council, proves that, even in the most modern plants, work study can still point the way to further improvement. It stresses the importance of keeping workpeople informed, and consulting with them in order to gain that essential co-operation without which the objectives of work study can never be fully achieved.

Copies of the film for showing can be obtained from the Central Film Library, Central Office of Information, Government Building, Bromyard Avenue, London, W.3.

Manual of Practice

To supplement practical work, a series of manuals on various aspects of productivity has been planned by the Association, and two new ones have now been issued. These are "General Galvanizing — A Manual of Good Practice" and "General Galvanizing—A Manual of Costing Practice."

The former sets out in simple terms all the essential factors for efficient processing and improving the quality of the coatings. The manual has been compiled by the technical committee of the Association in collaboration with the British Non-Ferrous Metals Research Association. Although it will be useful to works managers in the industry, it has been prepared particularly for the supervisor on the shop floor, to whom it should prove invaluable in his everyday work. It is fully indexed and marginal headings make reference easy.

The galvanizing process is outlined, and the merits of the wet and dry methods of galvanizing described. Preparation processes, such as degreasing, paint removal, pickling and fluxing are considered in detail, and special attention is paid to the careful preparation of castings for galvanizing.

A comprehensive section deals with the actual dipping of the products, and bath temperatures, rate and time of immersion, and aspects of withdrawal are also considered. Other sections deal with the control of ash and dross formation, and the methods of recovering zinc from these residuals.

The manual concludes with a description of a number of finishing treatments for galvanized work, and emphasizes the value of calcium plumbate paints for direct application to newly galvanized steel. The book is priced at 25s. 0d. and may be obtained from the Association at 34 Berkeley Square, London, W.1.

"A Manual of Costing Practice" has been prepared by W. E. Harrison (Past President of the Institute of Cost and Works Accountants), working with a small committee drawn from within the industry.

In two volumes, one containing the text, the other some 28 forms which can be used in operating the costing systems, it serves as a thorough guide to the galvanizer wishing to initiate cost finding procedures. It aims at focusing attention on the relation of costing to productivity in increasingly competitive conditions and, although intended primarily for galvanizers, it is felt that the manual will be of interest to many others in similar industries. It is available at 35s. 0d. for the two volumes.

A third book, "General Galvanizing —A Manual of Good Housekeeping and Safety," is in an advanced stage of preparation, and two further manuals, "Materials Handling in the Galvanizing Industry" and "Work Study in the Galvanizing Industry," are planned for future publication.

The standard of supervision is particularly important in the galvanizing industry and, to bring this home to members, three Supervisors' Conferences have been held at Balliol College, Oxford.

A training course for training galvanizers in work study took place at the Institute of Engineering Production at Birmingham University, and, gaining from this experience, a second course was run independently at Pendley Manor by the Association's staff. This is believed to have been the first course of its kind organized for a single industry in which examples used for practical training purposes were taken entirely from within the industry.

Forthcoming Conference

Much of the success of the productivity work has been due to the worldwide contacts built up as a result of the series of International Galvanizing Conferences organized by the Zinc Development Association. The Papers to be presented at the 5th International Conference, to be held in Brussels in June, will include the following main subjects: "Human Progress Through Technical Progress" (two Papers); "Preparation of Material for Galvanizing"; "Comparison between the Cook-Norteman and Sendzimir Processes"; "Relative Merits of Wet and Dry Galvanizing"; "Bath Heating"; "Variations in the Characteristics of Steel Wire as a Result of Hot Dip Galvanizing"; "Effect of Impurities and Additions on the Galvanizing Bath"; "Non-Destructive Testing of Galvanized Coatings"; "Materials Handling."

Industrial News *Home and Overseas*

New Address

It is understood that the address of the Professional Engineers' Appointments Bureau, as from Monday last, February 17, is now 39 Victoria Street, London, S.W.1, and the telephone number Abbey 1737.

For Metal Treatment Baths

A new process—the "Serseal" layer process (British patents applied for)—for eliminating fumes and steam from aqueous metal treatment baths, and for reducing heating costs, has recently been introduced by the Paints Division of **Imperial Chemical Industries Limited.** This process seals the surface of the processing liquid in the bath with a layer of inert material, and this not only checks fumes and steam but also reduces the amount of heat needed to keep the bath at a working temperature. The company states that by using this process, fuel economies of up to 75 per cent have been recorded under production conditions.

It is understood that the "Serseal" process can be operated without alteration to the processing tank. It was developed primarily for use in baths producing heavy phosphate coatings—such as those employed in the I.C.I. "Granodine" 101 process. It has now been extended to other "Granodine" processes. Certain precautions are necessary where work is is to be subsequently painted. Alternative grades of "Serseal" are available to suppress acid fumes and spray from pickling tanks, and to conserve heat in alkaline paint stripping vats.

Infra-Red Projector

An improved version of their standard infra-red projector which incorporates their tubular metal-sheathed heating element, has just been produced by **Metropolitan-Vickers Electrical Co. Ltd.** These projectors are designed for general infra-red heating applications, such as paint stoving, moisture extraction and preheating. They can be fitted end-to-end to form continuous troughs, assembled in banks, or used in angular formation to accommodate products of irregular shape. They can also be built into an enclosed plant, or used as robust portable units on stands.

The end and back covers can be dispensed with where close spacing is desirable, such as in enclosed ovens. These covers in the new model are robust steel pressings with ventilation louvres instead of perforations. This improved version, coupled with advanced manufacturing techniques, is a means of keeping down the price of the unit without sacrifice of quality, and of giving the user an improved product.

Films for Training

A residential course, organized by the Scientific Film Association, is to be held at Kingsgate College, near Broadstairs, Kent, from March 24 to 27 next, to study the subject of "The Use of Films in Supervisory Training." This course is designed both for those concerned with the training of supervisors and those who make films for this purpose.

The emphasis is deliberately placed on discussion. Students will have an opportunity to study in detail some recent films, and to assess their value for training; also to consider with experts the types of films required to meet the varied needs of contemporary supervisory training schemes.

Philippine Copper Production

The two principal copper mines in the Philippines, Atlas Consolidated and Lepanto, produced a total of 66,702,463 lb. of copper during 1957. This figure shows an increase of 17 million lb. over 1956, 14 million by Atlas and 3 million by Lepanto. Atlas Consolidated Mining and Development Corporation announced that the 1957 production figure was 38,121,923 lb., against a 1956 output of 23,957,320 lb., but said 1957 output was curtailed by a serious water shortage, which kept production from attaining its full potential for the year. The end of the drought was expected soon and the company's Toledo mill would produce a much higher amount this year, officials said. Lepanto Consolidated Mining Company Inc. announced its production for 1957 as 28,580,540 lb., which compares with the 1956 figure of 25,674,100 lb.

In the meantime, President Carlos Garcia is reported to have approved the purchase of machinery and equipment to the value of one-and-a-half million U.S. dollars for developing a low-grade copper ore deposit at Bagacay, off Samar Island, owned by the Marinduque Iron Mines Agents Inc. The report said that, despite the depressed price of copper in the world markets, Philippine producers are now busy increasing production in anticipation of increased demand in the coming year. The Base Metals Association of the Philippines has requested exemption from the Government's current austerity provisions. The Central Bank is studying the Association's claims that, in the light of depressed world market price for copper, the industry would need certain privileges in the matter of currency allocations to keep operations going.

A New Contract

As a direct result of a successful installation carried out in the past, **Heenan and Froude Limited** have received a further contract from British Ropes Limited for a number of Heenan Dynamatic eddy type couplings. The new contract is for a considerable number of couplings to work with wire-drawing machines under electronic control, and arranged so that the wire-drawing proceeds at constant linear speed and at constant tension, regardless of the progressive variation in the diameter of the coil of material during the process.

The process is particularly noteworthy in that the fastest possible speed is maintained throughout, without human attention.

Aluminium in Brazil

It is reported from Rio de Janeiro that output of aluminium by Brazil's two producers—Cia Brasiliera de Aluminio, Sorecaba, and the Electroquimica Beasiliera, Saramanha—was between 16,000 and 17,000 metric tons in 1957, against about 6,278 tons in 1956 and 1,664 tons in 1955. Nevertheless, the plants were not working to capacity during the past year.

Domestic consumption of aluminium is put at 30,000 tons annually, and it is expected to increase. Domestic bauxite reserves, in 31 deposits, are put at some 200 million metric tons. Output of of bauxite amounted to 70,000 tons in 1956, against 27,000 tons in 1954. Brazilian circles say that a third reduction plant may be set up by the U.S. Reynolds Metals and would be located on the San Francisco River.

Standards in Action

This year's conference of engineers responsible for standards matters will be held on May 21 at the Connaught Rooms in London. The conference will be opened by Mr. F. J. Erroll, Parliamentary Secretary to the Board of Trade. Mr. H. Stafford, who is chairman of the Standards Committee of the Institution of Production Engineers, will preside. The conference has been arranged by the Institution of Production Engineers and the British Standards Institution.

One of the main topics will be a discussion on the inch-metric problem from the standpoint of Britain's position as an exporter to both inch and metric countries. The agenda will also include a review of day-to-day problems facing standards engineers.

Those concerned with the application of standards in industry who would like to attend the conference should write to the Secretariat, I.Prod/B.S.I. Committee, British Standards House, 2 Park Street, London, W.1.

Enquiry from U.S.A.

Information has been supplied to the Board of Trade by the British Consulate-General at New York that Pfister Aluminium Corporation, 475 Franklin Turnpike, Allendale, New Jersey, are interested in obtaining supplies from U.K. sources of the following materials:—brass tube, $\frac{1}{4}$ in. and $\frac{7}{8}$ in., wall 0·015 in.; drawn tubing (sizes $\frac{1}{2}$ in. and under); drawn aluminium tubing in coils for gas and oil line work; drawn or extruded aluminium tubing, in sizes over 2 in.; aluminium strip, wire and rod.

Interested British companies are advised to contact the enquiring firm direct by air mail.

Rectifier Sets

It is announced by the Board of Trade that the Stores Department, South African Railways, Johannesburg, is calling for tenders for chrome plating rectifier sets. The closing date for receipt of tenders is March 14 next. A copy of the tender documents, including specification, is with the Export Services Branch, Board of Trade, Lacon House, Theobalds Road, London, W.C.1, and a photo-copy set may be obtained on payment of 7s. 0d. Ref. ESB/3889/58.

Magnesium in U.S.A.

Production of primary magnesium in the U.S. during 1957 is put at 81,263 tons in a preliminary estimate by the U.S. Bureau of Mines. This compares with 68,346 tons in 1956 and 61,135 tons in 1955. Shipments in 1957 were 51,576 tons. Also from preliminary reports,

recovery of secondary magnesium in 1957 was estimated at 9,500 tons.

Early reports showed estimated consumption of primary magnesium in 1957 was 47,000 tons, which was 12 per cent below 1956. A significant portion of this decrease was attributed to the drop in requirements of the metal as a reducing agent to produce titanium. Estimated producers' and consumers' stocks at the close of 1957 were approximately 75 per cent above total producers' and consumers' stocks on December 31, 1956.

Total imports of magnesium in all forms during the period January-September, 1957, were 898 tons, which was 242 tons more than imports during the entire year 1956. Exports for this nine-month period of 1957 were 1,364 tons, which was 2,234 tons below total exports for the same period in 1956. The Bureau said preliminary reports from the various producing countries showed some slight decreases in production of magnesium in 1957, and a few small increases compared with 1956.

Visiting Canada

Following the visit of the Canadian Trade Mission to this country last December, the **Scientific Instrument Manufacturers' Association** is arranging a Canadian tour of senior executives of leading British instrument manufacturers. Joining in Toronto in mid-March, the S.I.M.A. eight-man team aim to extend the goodwill created during the recent visit and investigate increasing trade in instruments between the U.K. and Canada. The team has the active support of the Dollar Exports Council, which endorses the enterprise of the instrument industry in organizing this return visit.

Export Licences

Intimation has been given by the National Association of Non-Ferrous Scrap Metal Merchants that an export licence for remelted zinc has been granted by the Board of Trade, and any member of the Association wishing to export this commodity should make application to—Industries and Manufactures Department, Division 4, Board of Trade, Horse Guards Avenue, London, S.W.1.

A Meeting at Geneva

On Thursday of last week, the Steering Committee of the International Wrought Non-Ferrous Metals Council held a meeting in Geneva under the chairmanship of Mr. C. A. Jacobsson, of Sweden. Delegates were present from Austria, Belgium, Denmark, Finland, France, Germany, Great Britain, Italy, Netherlands, Norway, Portugal, Sweden and Switzerland.

The committee received reports from its specialist sub-committees concerning the supply of copper ingot bars and copper cathodes in palletized form, progress being made in establishing a common method of costing for the European industry, compilation of capacity statistics for copper and copper alloy semi-finished products and international standardization, which will play an important part in the Common Market and in a possible Free Trade Area. In particular, all member countries are now urging their national standards organizations to make speedy progress in the field of international standardization in order that the industry may be ready to meet the demand of its European customers for delivery to agreed and approved standard specifications.

The statistical position for 1957 disclosed that the European copper and copper alloy fabricating industry had had a reasonably prosperous year, production of all products exceeding the figure for 1956, in spite of the continual fall of metal prices which has resulted in consumers ordering on a hand-to-mouth basis. Order books in the first few weeks of 1958 indicate that there is no general tendency at present for demand to fall off.

The International Council continues to follow closely developments in the European Common Market and negotiations with a view to establishing a Free Trade Area. Much purely factual information has been collected concerning the European pattern of trade, and it is proposed to have discussions on these important developments at all future meetings.

The General Assembly proposes to hold its annual general meeting in Italy in June, 1958.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week totalled 16,616 tons, comprising London 5,539; Liverpool 10,097; and Hull 980 tons. Copper stocks totalled 19,505 tons, and comprised London 11,272; Liverpool 6,358; Birmingham 1,175; Manchester 25; Swansea 425; and Hull 250 tons.

A New Forklift

After much detailed research, a series of four tests for the stability of fork lift trucks has recently been published. Designed to ensure an adequate safety margin under normal conditions, these tests fully recognize the need for all-round stability, by tilting the vehicle quite steeply on both fore-and-aft and lateral planes. In fact, the severest working conditions are actually reproduced.

With the full value of these tests in mind, **Ransomes, Sims and Jefferies Ltd.** are producing a new range of forklifts, based on their "FL" series. The latest of these, the NR 20, a development of the FL 2000, is about to enter the market. Rigidly conforming to the new international standards, it represents a goods-handling service of high efficiency and economy, and its safety is proved to the satisfaction of industry at large.

Power Station Boiler

A giant-capacity steam boiler has been planned for the new £40 million Thorpe Marsh power station announced by the Central Electricity Generating Board. This boiler, it is said, will have the highest known steam capacity in the world, and has been designed by **International Combustion Ltd.** to operate a 550,000 kW turbo-alternator. Nearly 1,700 tons of water per hr. will be evaporated into steam, and the output from this one boiler will exceed that of the whole of Battersea power station, which uses 17 boilers to achieve a total steam capacity of 471,000 kW.

A Removal

Continued increasing demand for their electrical timing equipment, relays, low voltage soldering irons and special-purpose automatic electrical control equipment has necessitated the moving of **Electrical Remote Control Company Ltd.** to a new factory situated on a half-acre site at Bush Fair, Tye Green, Harlow New Town, Essex.

This factory is, we understand, the first on the new industrial estate at Tye Green, which is within the area of Harlow New Town. These new premises will also be accommodating Equipment and Services Ltd., whose activities include electrical wholesale and the distribution of drawing office supplies in the area of the new town.

Birlec Exhibits

New ideas in electric melting are to be shown to industry at an exhibition to be held by **Birlec Limited,** in conjunction with the London Electricity Board, at the Board's premises in Nelson Street, East Ham, London, from March 10 to 12 next. Principal exhibits will be the new Birlec-Morgan electric diecasting furnace, the latest type of Birlec Tama tilting furnace, and the Birlec Ajaxomatic holding and pouring unit for aluminium diecasting, operating under production conditions with a Herbert-Reed-Prentice 1½ G. die-caster.

Also exhibited will be a scale model of the latest Birlec Detroit rocking arc electric melting furnace. Admission to this exhibition is free by invitation from either Birlec Ltd. or the London Electricity Board.

Malayan Tin Shipments

Tin shipments from Singapore during the first half of February totalled 812¾ tons, according to the Straits Trading Company. This compares with shipments of 560¾ tons in the first half of January and 1,553½ tons in the first half of February last year. Of the latest shipments, the United Kingdom took 35 tons, the United States 205, Europe 172, Japan 268, the Pacific 0·5, India 33¾, South America 32¾, Africa 0·75 and Australasia 65 tons.

Tin shipments from Penang during the same period amounted to 1,798 tons, compared with 2,471½ tons in the first half of January and 1,494¾ tons in the first half of February last year. Of this month's shipments so far, the United Kingdom took 455 tons, United Kingdom options 10, the United States 770, Europe 267, Canada 50, Japan 10, India 111, South America 25, Australasia 75 and the Middle East 25.

Speeding Welding Time

Increased production of welded cylindrical vessels with a wide range of sizes is now being obtained at the Barrow-in-Furness works of Vickers-Armstrongs (Engineers) Limited with the aid of a Fusarc high-lift boom and traversing roller bed installation. The equipment is being used for the welding of rotary kilns, storage tanks, H.P. and L.P. heaters, rotary coolers, and for other cylindrical fabrications.

The high-lift boom equipment consists basically of a boom of 17 ft. 6 in. in length, one end of which is mounted so that the height of the boom above the roller bed is variable to accommodate vessels of varying diameters. At the other end of the boom is a Fusarc automatic welding head. Provision is made for the operator to be carried at the end of the boom. In the case of internal welds on small diameters, the operator is carried prone.

The roller bed can support, turn and traverse a weight of up to 48 tons, and is adjustable to accommodate vessels with diameters ranging from 2 ft. to 15 ft. Both the turning and traverse motions are controllable at welding speeds, so that both longitudinal and circumferential welds may be carried out by moving the

workpiece while the welding head remains stationary. All motions of the roller bed, as well as all welding conditions, can be controlled by the operator stationed at the welding head. Power is supplied by a Quasi-Arc 1,000 amp. generator, and Seamec No. 2 continuous covered electrode of the patented Fusarc type is used, at currents up to 750 amp. for internal welding and 900 amp. for external welding.

Material Handling Pump

Widely used in the United States and now being manufactured in this country by **Alfred Bullows and Sons Ltd.**, under licence from the Binks Manufacturing Company, of Chicago, the Bullows-Binks 52/61 "Pogo" material handling pump enables paint to be used straight from a bulk container as delivered by the paint supplier, and this, in turn, makes possible the installation of a small or medium size circulating system at a fraction of the cost hitherto.

The introduction of this new technique, with substantial saving in cost, has led to a heavy demand for the pump and it is now in quantity production in the U.K. As a result, the company has announced a price reduction, and the present price of the unit is £55, plus 20 per cent, with delivery reduced to six week. It is understood that the new price applies to outstanding orders as well as new orders.

A New Company

A joint company is being formed between **Herbert Morris Ltd.** and **Brown, Lenox and Co. (London) Ltd.**, and will commence operations in April next at works in Millwall, London, E. This company will continue the work of the existing lifting gear department of Brown, Lenox, whilst at the same time taking over the spares and servicing organization for Morris equipment in the area.

This new organization will provide additional benefits for users of Morris equipment in the South of England, and it will also expand the facilities available to customers of Brown, Lenox. It is understood that the new company will have the fullest support of the parent companies, and the management will be the same as that which now operates the chain and lifting gear service department of the Millwall works of Brown, Lenox.

An Appointment

It has been announced by **Fielding and Platt Ltd.**, of Gloucester, that Mr. S. G. Medcraft, formerly London sales representative of the company, has now been appointed the company's sales manager.

Malaya and Tin Agreement

It is reported from Ipoh that Mr. R. A. Abdul Karim, secretary of the Malayan Mining Employees' Union has stated that Malaya should consider withdrawing from the International Tin Agreement. Describing the I.T.A. as "a failure," Mr. Karim, who is a nominated member of the Federal Legislative Council, said in a statement that he felt Malaya's withdrawal from the Agreement could be done without difficulty because she was producing half the world's output of tin. "Consuming countries cannot afford to ignore Malaya," he remarked.

The I.T.A., he continued, had been devised to help consuming countries but, since it had not achieved its object, it was time Malaya gave consideration to its urgent duty of protecting the industry and its own interests. The failure of the Agreement was causing widespread unemployment. Recent developments had reduced the price of tin considerably. But Mr. Karim did not elaborate on what the "developments" were.

Jamaican Exports

Figures issued in Kingston recently show that Jamaica's alumina exports last year more than doubled in quantity while the value of shipments was not quite twice as much as in 1956. Exports in 1956 earned £5,802,701, and amounted to 207,333 tons. In 1957, comparative figures were £11,438,531 and 435,746 tons. Canada took 345,541 tons in 1957, against 194,792 in the previous year.

A Westinghouse Exhibit

At the Electrical Engineers' Exhibition, to be held at Earls Court, London, next month, the **Westinghouse Brake and Signal Company Limited** will be showing a comprehensive range of silicon, germanium, selenium and copper-oxide rectifiers which covers the entire field of power rectifiers. The most suitable rectifier for each application is suggested, backed by Westinghouse engineering experience in power conversion problems for a third of a century.

Examples of large equipments employing silicon and germanium rectifiers will be demonstrated, while improvements in selenium and copper-oxide rectifiers will also be shown, as these two established rectifiers are by no means superseded.

Westinghouse ability to execute contracts of several megawatts output is to be illustrated. These may involve control systems for accurate performance, and here many original ideas have been developed. Also, large numbers of standard rectifier equipments, of sound engineering design, are supplied from stock at competitive prices.

Copper Wire from India

It has been announced in Bombay by the Chief Controller of Exports that the Government of India have decided to regulate the export of bare copper wire and conductors for electrical purposes on an *ad hoc* basis.

Non-Ferrous Scrap Metal Merchants

As a result of the resolution adopted at the half-yearly general meeting of the **National Association of Non-Ferrous Scrap Metal Merchants** regarding the rules of the association, a meeting of the committee set up for that purpose was held last month and the question of the desirability of amending the rules was discussed. Agreement was reached on a number of points, but it was felt that the only satisfactory way in which the views of the association members could be ascertained would be for a recommendation to be put forward that the Council should resign *en bloc* so that members would have the opportunity of confirming by vote whether or not the Council enjoyed the full confidence of the association.

The Council has accepted this recommendation and, therefore, in order to establish beyond any doubt whether or not the Council, as constituted under the present rules, does or does not enjoy the confidence of the members, the whole of the Council has resigned, and all except one have agreed to stand for re-election. Members of the association have now received this information from the secretary of the association in a letter, which goes on to give the following details:—

"As you will recollect, certain amendments to the Rules were suggested at the last General Meeting of the Association which would have the effect of excluding certain members from eligibility to serve on the Council. The Council expressed the unanimous view that it would be neither equitable nor in the best interests of the Association to place such restriction on individual members from serving on the Council. No member of the Council would, on the other hand, wish to continue in office unless he was certain that he had the confidence of the general body of members.

"In accordance with the normal procedure adopted before any Council election, a nomination form is enclosed which should be returned to me not later than Monday, 24th February, 1958, supported by the written assent of all nominees, other than Council members who have now resigned, to the effect that, if elected, they will be willing to stand as Council members and attend meetings of the Council regularly.

"In this instance it is not intended to convene a General Meeting and therefore all votes will be recorded in writing to the Secretary. On the 26th February a voting paper will be despatched to members to enable them to record their votes and these voting papers are to be returned to the Secretary by the 4th March in an envelope provided for this purpose which will be opened in the presence of the scrutineers, the President, Mr. M. C. Elton and Mr. S. Sternberg, in the Secretary's office.

"It was considered advisable for the Council to resign immediately so that the new Council will be in office prior to the June Annual General Meeting and thus avoid complications which might arise if the resignations had been delayed until that time.

"Until the new Council has been elected the conduct of the Association's business will be carried on by the last elected Council.

"The new Council, when constituted, will elect from amongst their number a President and Vice-President who will hold office until the Annual General Meeting in June, 1958."

Forthcoming Meetings

February 26 — Manchester Metallurgical Society. Manchester Room, The Central Library, Manchester. "Metallurgy of Tantalum, Niobium and Beryllium." G. L. Miller. 6.30 p.m.

February 26 — Institution of Production Engineers. Shrewsbury Section. The Walker Technical College, Oakengates. "Shell Moulding." G. Hannaford and T. Lawrence. 7.30 p.m.

February 27 — Institution of Production Engineers. Halifax and Huddersfield Section. The White Swan Hotel, Halifax. "Wire Production." C. Coates. 7.30 p.m.

February 27—Southampton Metallurgical Society. The University, Southampton. "Non-Destructive Testing of Metals." Dr. Hanstock. 7.15 p.m.

February 28—Institute of Metal Finishing. Sheffield and North-East Branch. Grand Hotel, Fitzwilliam Room, Sheffield. "High Speed Bright Silver." H. E. Hutchinson. 7 p.m.

Metal Market News

FAIRLY steady conditions prevailed on the Metal Exchange last week, but copper lost more ground and of the four metals it is probably the worst thought of. The United States background, which means so much to Whittington Avenue, continued to deteriorate, and although official pronouncements across the Atlantic continue to sound a cautiously optimistic note, the prospects of an upturn at the half-year seem to be not so bright as at one time they were thought to be. True, the outlook for steel appears to be a little better, and at the end of last week it was reported that the users of tin were at long last showing some interest. But unemployment is on a big scale and there is no certainty that the figures will not show a further increase. In the U.K., too, the number of those without jobs has risen during the past few weeks. Stock markets on both sides of the Atlantic have been depressed and our share values have suffered under the influence of the wilting American securities. Stock Exchange quotations were marked down following the Rochdale election result, and labour troubles, causing delay and loss of production, have added to the general feeling of malaise. Moreover, the details of non-ferrous operations in December, issued by the British Bureau of Non-Ferrous Metal Statistics, which are shown below, do not make encouraging reading, even allowing for the incidence of the Christmas holiday. One way and another, therefore, the markets have had a good deal to contend against and it is, therefore, rather good that lead and tin, at any rate, were able to register modest gains.

In copper, there was a turnover of about 8,000 tons and, although values closed above the worst levels recorded, there was, nevertheless, a drop of £2 15s. 0d. in cash and of £3 in three months. During the week, cash copper changed hands at £159 10s. 0d., but at the close on Friday afternoon last the quotation was £161 5s. 0d. Three months was £1 above this at £162 5s. 0d. At the beginning of the week the custom smelters cut their price by 50 points to 23½ cents, and the Belgian producers came down from 23½ francs to 23 francs. Stocks in L.M.E. warehouses were increased by 100 tons to 19,855 tons, but it is thought that in the very near future some sizeable reductions may be seen. The newly-created "European electro price" is now under way as a feature of the metal situation and so far, apart from a couple of exceptional days, it appears to be running about £2 to £3 over the settlement quotation. The London standard copper market last week set up a new low record since trading was started afresh after the war in 1953. Opinion is divided about the likelihood of the producers in the United States reducing below 25 cents, but such a movement is by no means out of the question. In any case, we must expect an import duty on copper entering the United States to be imposed on July 1, and the market here is getting itself accustomed to that idea, with all the problems that will inevitably accompany it.

In tin, there was less evidence of Pool buying, cash gaining £1 and forward £2 on a turnover of 1,550 tons. Lead closed 7s. 6d. up both positions, while zinc lost £1 15s. 0d. prompt and £1 forward. Copper consumption in December was 8,748 tons down at 46,860 tons, while stocks increased to 70,871 tons. Last year's U.K. consumption, at 778,219 tons, was 2,600 tons lower than in 1956. In lead, the year's total was 349,156 tons, compared with 357,694 tons in 1956. December usage was down by 4,500 tons to 26,530 tons, but stocks increased from 48,065 tons to 51,295 tons. Zinc consumption last year was 316,405 tons, about 2,000 tons lower than in the previous year. December consumption showed a drop of 2,300 tons to 24,419 tons, while stocks were 3,000 tons up at 44,926 tons.

New York

Copper continued depressed on the U.S. non-ferrous metal market for the past week. Tin was mixed, while lead was quiet and zinc was reported to be fairly active. In the copper market, custom smelters were quoting or indicating 23½ cents per lb. for electrolytic copper, with the business done negligible. Producers continued to do business at 25 cents a lb., but with the increasing spread between the custom smelter and the producer prices, pressure was rising on the producer price level, trade sources said. If the producer price should drop to 24 cents a lb. it would bring up for consideration reimposition of a 2 cent tariff duty. Under present law, if the domestic average price of copper should drop below 24 cents for any calendar month, the Tariff Commission must notify the President of such development. Thereupon, the President has 20 days within which to reimpose the tariff duty of 2 cents. This tariff provision expires on June 30, 1958.

U.S. brass mills report that there has been no noticeable improvement in their orders and that, in some cases, shipments have declined further because of the low rate of business booked in previous months. Customers continue to ask for quick delivery, brass officials say, and that may mean that inventories are being held to a minimum.

Lead activity was quiet, according to sellers, but fair sales of zinc were recorded by some leading traders.

One major producer said that steel companies were buying Prime Western Zinc, which indicated that they were short on their inventories and needed the metal for current operations.

Tin, after some early firmness, slipped back on fears connected with the announcement that Soviet tin would henceforth be tenderable on the London Metal Exchange, and on increased offerings from the Far East. At the low counts, fair dealer buying of March and April metal was noted.

Birmingham

Workers registered as unemployed in the Midland Region have increased from 21,305 to 25,179 in a month, but the local average still compares favourably with national figures at 1·2 per cent, against 1·8 per cent. Ministry of Labour officials do not regard the increase of 4,000 as an indication of recession. Some of it is due, no doubt, to seasonal declines in work, notably in the building trade, which always suffers at this season of the year. There has been short-time working in non-ferrous casting foundries, copper refining works, and in aluminium foundries. Industries working for the motor trade maintain a good level of employment. Trade in cast iron holloware is slack, and sales of edge tools are lower. Export business has been hit by keen competition.

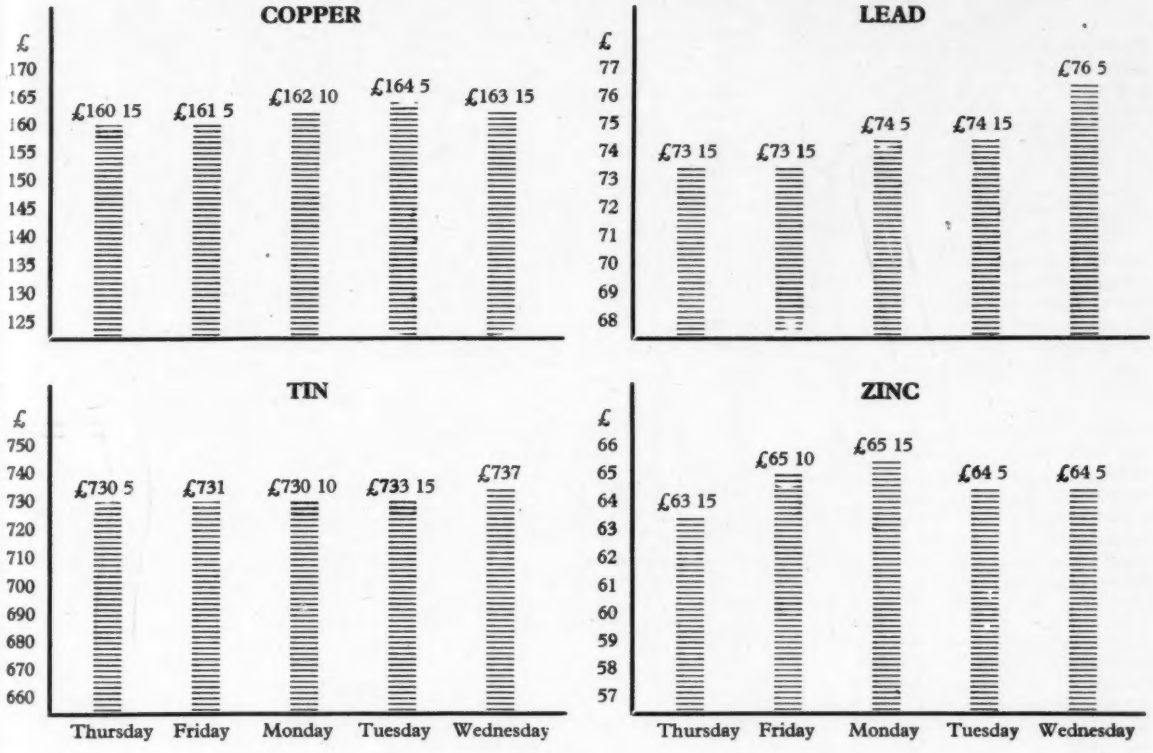
New business is more difficult to obtain in the iron and steel industry, although some departments are still very active, particularly plates and sheets. Midland industry is getting a big share of engineering contracts for power plant in the new fields of atomic and nuclear energy, and electrical equipment manufacturers are very well situated for work. There is also a brisk demand for heavy iron castings for the engineering industries, but there has been no improvement in the market for light castings.

Bulgaria

Reports reaching Vienna say that after six years of intensive prospecting work, Bulgarian and Soviet geologists have discovered a large number of deposits of lead, zinc, copper, silver, and cadmium ores. In particular, some 37 lead-zinc lodes have been found in the three areas of Harmanli, Swilengrad and Ivailovgrad, and mining operations have started there. It is believed that total reserves of lead-zinc ore in the above-mentioned areas are around 15 million tons, and it is planned to sink enough mines to support an output of 330,000 tons of ore. Furthermore, a plant with an annual output of 50,000 tons of concentrate is to be set up.

METAL PRICE CHANGES

LONDON METAL EXCHANGE, Thursday 13 February 1958 to Wednesday 19 February 1958



OVERSEAS PRICES

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≏ £/ton	Canada c/lb ≏ £/ton	France fr/kg ≏ £/ton	Italy lire/kg ≏ £/ton	Switzerland fr/kg ≏ £/ton	United States c/lb ≏ £ ton
Aluminium		24.63 203 10	210 182 15	400 232 0	2.50 209 0	28.10 224 17 6
Antimony 99.0			195 169 12 6	430 249 10		29.00 232 0
Cadmium			1,400 1,218 0	2,550 1,479 0		155.00 1,240 0
Copper						
Crude						
Wire bars 99.9				340 197 5 0		
Electrolytic	23.00 168 2 6	24.75 202 10	216 188 0		2.20 184 0	25.00 200 0
Lead		12.25 101 2 6	123 107 0	183 106 2 6	.92 77 0	13.00 104 0
Magnesium						
Nickel		71.50 590 10	1,205 104 17 6	1,330 771 10	8.10 677 2 6	74.00 592 0
Tin	100.75 736 10		882 767 7 6	1,400 812 0	8.80 735 17 6	93.37 747 0
Zinc						
Prime western		10.00 82 12 6				10.00 80 0
High grade 99.95		10.60 87 10 0				
High grade 99.99		11.00 90 5				
Thermic			107.12 93 2 6			
Electrolytic			115.12 100 2 6	161 93 7 6	.85 71	11.75 94 0

NON-FERROUS METAL PRICES

(All prices quoted are those available at 12 noon 19/2/58)

PRIMARY METALS

		£	s.	d.
Aluminium Ingots	ton	197	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%	„	190	0	0
Antimony Oxide	„	180	0	0
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		10	0
Calcium	„	2	0	0
Cerium 99%	„	13	18	0
Chromium	„		6	11
Cobalt	„		16	0
Columbite	per unit		—	
Copper H.C. Electro	ton	163	15	0
Fire Refined 99·70%	„	†162	0	0
Fire Refined 99·50%	„	161	0	0
Copper Sulphate	„	64	0	0
Germanium	grm.		3	4
Gold	oz.	12	9	0
Indium	„		10	0
Iridium	„	27	0	0
Lanthanum	grm.		15	0
Lead English	ton	76	5	0
Magnesium Ingots	lb.		2	5½
Notched Bar	„		2	10½
Powder Grade 4	„		6	3
Alloy Ingot, A8 or AZ91	„		2	8
Manganese Metal	ton	300	0	0
Mercury	flask	75	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	
Palladium	„	7	10	0
Platinum	„	26	15	0
Rhodium	„	40	0	0
Ruthenium	„	16	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	4⅜
Tellurium	lb.		15	0
Tin	ton	737	0	0
Titanium	lb.		19	6
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	64	1	10½
Dust 95/97%	„	104	0	0
Dust 98/99%	„	110	0	0
Granulated 99+%	„	89	1	10½
Granulated 99·99+%	„	102	5	0

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

Aluminium Alloy (Virgin)		£	s.	d.
B.S. 1490 L.M.5	ton	227	0	0
B.S. 1490 L.M.6	„	217	0	0
B.S. 1490 L.M.7	„	231	0	0
B.S. 1490 L.M.8	„	220	0	0
B.S. 1490 L.M.9	„	218	0	0
B.S. 1490 L.M.10	„	236	0	0
B.S. 1490 L.M.11	„	231	0	0
B.S. 1490 L.M.12	„	240	0	0
B.S. 1490 L.M.13	„	231	0	0
B.S. 1490 L.M.14	„	241	0	0
B.S. 1490 L.M.15	„	227	0	0
B.S. 1490 L.M.16	„	222	0	0
B.S. 1490 L.M.18	„	220	0	0
B.S. 1490 L.M.22	„	228	0	0

		£	s.	d.
†**Aluminium Alloy (Secondary)**				
B.S. 1490 L.M.1	ton	153	10	0
B.S. 1490 L.M.2	„	160	0	0
B.S. 1490 L.M.4	„	182	10	0
B.S. 1490 L.M.6	„	205	0	0

†Average selling prices for December.

***Aluminium Bronze**				
BSS 1400 AB.1	ton	199	0	0
BSS 1400 AB.2	„		—	
***Brass**				
BSS 1400-B3 65/35	„	125	0	0
BSS 249	„		—	
BSS 1400-B6 85/15	„		—	
***Gunmetal**				
R.C.H. 3/4%	ton		—	
(85/5/5/5)	„	152	0	0
(86/7/5/2)	„	162	0	0
(88/10/2/1)	„		—	
(88/10/2/½)	„	218	0	0
Manganese Bronze				
BSS 1400 HTB1	„	168	0	0
BSS 1400 HTB2	„		—	
BSS 1400 HTB3	„		—	
Nickel Silver				
Casting Quality 12%	„		nom.	
„ „ 16%	„		nom.	
„ „ 18%	„		nom.	
***Phosphor Bronze** 2B8 guaranteed A.I.D. released	„	235	0	0
Phosphor Copper				
10%	„	199	0	0
15%	„	208	0	0
Phosphor Tin				
5%	ton		—	
Silicon Bronze				
BSS 1400-SB1	„		—	
Solder, soft, BSS 219				
Grade C Tinmans	„	347	3	0
Grade D Plumbers	„	281	6	0
Grade M	„	380	0	0
Solder, Brazing, BSS 1845				
Type 8 (Granulated)	lb.		—	
Type 9 „	„		—	
Zinc Alloys				
Mazak III	ton	95	10	0
Mazak V	„	99	10	0
Kayem	„	105	10	0
Kayem II	„	111	10	0
Sodium-Zinc	lb.		2	5

*Average prices for the last week-end.

SEMI-FABRICATED PRODUCTS

Prices of all semi-fabricated products vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			£	s.	d.
Sheet 10	S.W.G.	lb.		2	9
Sheet 18	S.W.G.	„		2	11
Sheet 24	S.W.G.	„		3	2
Strip 10	S.W.G.	„		2	9
Strip 18	S.W.G.	„		2	10
Strip 24	S.W.G.	„		2	11½
Circles 22	S.W.G.	„		3	3
Circles 18	S.W.G.	„		3	2
Circles 12	S.W.G.	„		3	1
Plate as rolled		„		2	8½
Sections		„		3	2½
Wire 10	S.W.G.	„		3	0
Tubes 1 in. o.d. 16	S.W.G.	„		4	1

Aluminium Alloys			£	s.	d.
BS1470. HS10W.		lb.			
Sheet 10	S.W.G.	„		3	1½
Sheet 18	S.W.G.	„		3	4
Sheet 24	S.W.G.	„		3	11½
Strip 10	S.W.G.	„		3	1½
Strip 18	S.W.G.	„		3	3
Strip 24	S.W.G.	„		3	11
BS1477 HP30M. Plate as rolled				2	11½
BS1470. HC15WP.					
Sheet 10	S.W.G.	lb.		3	9½
Sheet 18	S.W.G.	„		4	1½
Sheet 24	S.W.G.	„		4	11½
Strip 10	S.W.G.	„		3	10½
Strip 18	S.W.G.	„		4	1½
Strip 24	S.W.G.	„		4	9
BS1477. HPC15WP. Plate heat treated		„		3	6½
BS1475. HG10W. Wire 10	S.W.G.	„		3	10½
BS1471. HT10WP Tubes 1 in. o.d. 16	S.W.G.	„		5	0
BS1476. HE10WP. Sections		„		3	2
Beryllium Copper					
Strip		„	1	4	11
Rod		„	1	1	6
Wire		„	1	4	9
Brass Tubes		„		1	4⅛
Brazed Tubes		„		—	
Drawn Strip Sections		„		—	
Sheet		ton		—	
Strip		„	202	5	0
Extruded Bar		lb.		1	7½
Extruded Bar (Pure Metal Basis)		„		—	
Condenser Plate (Yellow Metal)		ton	137	0	0
Condenser Plate (Naval Brass)		„	147	0	0
Wire		lb.		2	2½
Bronze Sheet and Strip		ton		—	
Copper Tubes		lb.		1	7⅛
Sheet		ton	187	0	0
Strip		„	187	0	0
Plain Plates		„		—	
Locomotive Rods		„		—	
H.C. Wire		„	209	15	0
Cupro Nickel Tubes 70/30		lb.		3	1⅛
Lead Pipes (London)		ton	115	5	0
Sheets (London)		„	113	0	0
Tellurium Lead		„	£6 extra		
Nickel Silver Rods		lb.		—	
Sheet and Strip 7%		„		3	2½
Wire 10%		„		3	9½
Phosphor Bronze Wire		„		3	4⅛
Titanium					
Billet		lb.	4	10	0
Sheet		„	6	12	0
Wire		„	9	10	0
Tube		„	16	0	0
Zinc Sheets, English destinations		ton	98	0	0
Strip		„		nom.	

Financial News

Metal Statistics

Detailed figures of the consumption and output of non-ferrous metals for the month of Dec., 1957, have been issued by the British Bureau of Non-Ferrous Metal Statistics, as follow in long tons:—

COPPER	Gross Weight	Copper Content
Wire	20,951	20,619
Rods, bars and sections	10,801	7,100
Sheet, strips and plate	11,446	9,064
Tubes	5,868	5,336
Castings and miscellaneous	7,101	—
Sulphate	2,815	—
	58,982	48,634
Of which:		
Consumption of Virgin Copper		38,104
Consumption of Copper and Alloy Scrap (Copper Content)		10,530

ZINC	
Galvanizing	6,299
Brass	7,598
Rolled Zinc	1,473
Zinc Oxide	2,208
Zinc Die-casting alloy	5,004
Zinc Dust	854
Miscellaneous Uses	983
Total, All Trades	24,419
Of which:	
High purity 99·99 per cent	5,295
Electrolytic and high grade 99·95 per cent	4,114
Prime Western, G.O.B. and debased	8,140
Remelted	457
Scrap Brass and other Cu alloys	3,451
Scrap Zinc, alloys and residues	2,660

ANTIMONY	
Batteries	49
Other Antimonial Lead	45
Bearings	31
Oxides—for White Pigments	108
Oxides—other	109
Miscellaneous Uses	11
Sulphides	3
Total Consumption	356
Antimony in Scrap	
For Antimonial Lead	350
For Other Uses	12
Total Consumption	362

LEAD	
Cables	7,897
Batteries	2,494
Battery Oxides	2,253
Tetra Ethyl Lead	1,948
Other Oxides and Compounds	1,939
White Lead	737
Shot	349
Sheet and Pipe	4,619
Foil and Collapsible Tubes	386
Other Rolled and Extruded	451
Solder	1,041
Alloys	1,451
Miscellaneous Uses	965
Total	26,530

CADMIUM	
Plating Anodes	46·40
Plating Salts	10·85
Alloys: Cadmium Copper	5·05
Alloys: Other	2·50
Batteries: Alkaline	3·10
Batteries: Dry	0·25
Solder	2·05
Colours	11·50
Miscellaneous Uses	2·15
Total Consumption	83·85

TIN	
Tinplate	584
Tinning:	
Copper Wire	45
Steel Wire	9
All other	57
Solder	118
Alloys	462
Foil and Collapsible Tubes, etc.	51
Tin Compounds and Salts	88
Miscellaneous Uses	6
Total Consumption	1,420

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons, Limited, Company Registration Agents, Chancery Lane, W.C.2.

John Morris and Co. (Whickham) Ltd. (596085), Market Lane, Whickham, Newcastle upon Tyne. Registered December 30, 1957. To search for, raise and work coal, iron, ore, tin and other minerals, ores and deposits, etc. Nominal capital, £5,000 in £1 shares. Directors: J. Morris, H. Campbell and J. Adams.

Ultra-Guards Limited (596181), 90 Burlington Street, Aston, Birmingham, 6. Registered December 31, 1957. To carry on business of manufacturers of and dealers in machinery guards, safety appliances, etc. Nominal capital, £10,000 in £1 shares. Permanent managing director: H. R. Gleadall.

Hardchromers Limited (596429), 7 Yarburgh Street, Manchester, 16. Registered January 2, 1958. To carry on business of platers, etc. Nominal capital, £100 in £1 shares. Directors: J. H. Lloyd and Mrs. F. G. Lloyd.

Non-Ferrous Stockholders Limited (596723), 9 Mansfield Street, W.1. Registered January 8, 1958. Nominal capital, £10,000 in £1 shares. Directors to be appointed by subscribers.

Scrap Metal Prices

Merchants' average buying prices delivered, per ton, 18/2/58.

	£
Aluminium	
New Cuttings	160
Old Rolled	130
Segregated Turnings	95
Brass	
Cuttings	108
Rod Ends	104
Heavy Yellow	85
Light	80
Rolled	98
Collected Scrap	83
Turnings	98
Copper	
Wire	136
Firebox, cut up	136
Heavy	130
Light	125
Cuttings	136
Turnings	119
Braziery	110
Gunmetal	
Gear Wheels	140
Admiralty	140
Commercial	115
Turnings	110
Lead	
Scrap	65
Nickel	
Cuttings	—
Anodes	530
Phosphor Bronze	
Scrap	115
Turnings	110
Zinc	
Remelted	55
Cuttings	43
Old Zinc	30

The latest available scrap prices quoted on foreign markets are as follow. (The figures in brackets give the English equivalents in £1 per ton):—

West Germany (D-marks per 100 kilos):		
Used copper wire	(£143.10.0)	165
Heavy copper	(£143.10.0)	165
Light copper	(£121.17.6)	140
Heavy brass	(£91.7.6)	105
Light brass	(£65.5.0)	75
Soft lead scrap	(£56.10.0)	65
Zinc scrap	(£39.2.6)	45
Used aluminium unsorted	(£82.12.6)	95
France (francs per kilo):		
Copper	(£187.0.0)	215
Heavy copper	(£187.0.0)	215
Light brass	(£134.17.6)	155
Zinc castings	(£67.0.0)	77
Tin	(£565.10.0)	650
Aluminium pans (98½ per cent)	(£139.5.0)	160

Italy (lire per kilo):		
Aluminium soft sheet clippings (new)	(£194.7.6)	335
Aluminium copper alloy	(£104.10.0)	180
Lead, soft, first quality	(£87.0.0)	150
Lead, battery plates	(£53.7.6)	92
Copper, first grade	(£159.10.0)	275
Copper, second grade	(£148.0.0)	255
Bronze, first quality machinery	(£165.7.6)	285
Bronze, commercial gunmetal	(£136.7.6)	235
Brass, heavy	(£110.5.0)	190
Brass, light	(£98.12.6)	170
Brass, bar turnings	(£113.2.6)	195
New zinc sheet clippings	(£58.0.0)	100
Old zinc	(£49.7.6)	85

THE STOCK EXCHANGE

Industrials Still Rather Dull and Uncertain In Tone

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 18 FEBRUARY	+RISE —FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1958 HIGH	1958 LOW	1957 HIGH	1957 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	18/9xd	—4½d.	10	10	10 13 3	19/9	18/9	28/3	18/–
400,000	2/–	Anti-Attrition Metal	1/6		8½	7½	11 6 9	1/6	1/3	2/6	1/6
33,639,483	Stk. (£1)	Associated Electrical Industries ...	47/9	—9d.	15	15	6 5 9	50/–	47/6	72/3	47/9
1,590,000	1	Birfield Industries	50/9	—1/3	15	20N	5 18 3	53/9	50/9	70/–	48/9
3,196,667	1	Birmid Industries	57/–	—3d.	17½	17½	6 2 9	57/9	56/3	80/6	55/9
5,630,344	Stk. (£1)	Birmingham Small Arms	25/–	—6d.	10	8	8 0 0	26/7½	25/–	33/–	21/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	15/–		5	5	6 13 3		—	16/–	15/–
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	16/6		6	6	7 5 6	17/–	16/6	19/–	16/6
500,000	1	Bolton (Thos.) & Sons	28/9		12½	12½	8 14 0		—	30/3	28/9
300,000	1	Ditto Pref. 5%	15/3		5	5	6 11 3		—	16/9	14/3
160,000	1	Booth (James) & Co. Cum. Pref. 7%	19/–		7	7	7 7 3		—	22/3	18/9
9,000,000	Stk. (£1)	British Aluminium Co.	44/3	+3d.	12	12	5 8 6	44/9	41/3	72/–	38/3
1,500,000	Stk. (£1)	Ditto Pref. 6%	19/3		6	6	6 4 9	19/3	18/4½	21/6	18/–
15,000,000	Stk. (£1)	British Insulated Callender's Cables	41/–	—1/–	12½	12½	6 2 0	42/–	38/10½	55/–	40/–
17,047,166	Stk. (£1)	British Oxygen Co. Ltd., Ord. ...	29/–	—9d.	10	15N	6 18 0	32/3	29/–	39/–	29/6
600,000	Stk. (5/–)	Canning (W.) & Co.	20/7½		25	25	6 2 0	20/7½	20/1½	24/6	19/3
60,484	1/–	Carr (Chas.)	2/1½xd	+1½d.	25	25	X8 4 9	2/3	2/–	3/6	2/1½
150,000	2/–	Case (Alfred) & Co. Ltd.	4/6		25	25	11 2 3	4/9	4/4	4/6	4/–
555,000	1	Clifford (Chas.) Ltd.	16/–		10	15N	12 10 0	16/6	16/–	20/6	15/9
45,000	1	Ditto Cum. Pref. 6%	15/10½		6	6	7 11 3		—	17/6	16/–
250,000	2/–	Coley Metals	3/7½	—4½d.	25	25	13 15 9	4/6	3/7½	5/7½	3/9
8,730,596	1	Cons. Zinc Corp.†	43/–	—3/9	22½	22½	10 9 3	51/6	43/–	92/6	49/–
1,136,233	1	Davy & United	47/6	—6d.	15	12½	6 6 3	48/–	46/3	60/6	42/6
2,750,000	5/–	Delta Metal	20/1½	—3d.	•17½	•17½	4 7 0	21/4½	19/9	28/6	19/–
4,160,000	Stk. (£1)	Enfield Rolling Mills Ltd.	26/–	—6d.	15B	22½	9 12 3	26/6	24/–	38/6	25/–
500,000	1	Evered & Co.	41/3		15	15	7 5 6	41/3	41/–	52/9	42/–
18,000,000	Stk. (£1)	General Electric Co.	30/7½	—10½d.	12½	14	Y7 10 3	38/7½	30/7½	59/–	38/–
1,250,000	Stk. (10/–)	General Refractories Ltd.	28/–		17½	17½	6 5 0	28/3	27/3	37/–	26/9
401,240	1	Gibbons (Dudley) Ltd.	65/–	+1/–	15	12	4 12 3	65/–	64/–	71/–	53/–
750,000	5/–	Glacier Metal Co. Ltd.	5/9		11½	11½	10 0 0	6/–	5/7½	8/1½	5/10½
1,750,000	5/–	Glynwed Tubes	13/4½	+4½d.	20	20	7 9 6	13/4½	12/10½	18/–	12/6
3,614,032	10/–	Goodlass Wall & Lead Industries ...	28/3		18	16	6 7 6	29/9	28/3	37/3	28/9
342,195	1	Greenwood & Batley	46/10½		17½	17½	7 9 3		—	50/–	46/–
396,000	5/–	Harrison (B'ham) Ord.	11/6		•15	•30‡	6 10 6		—	16/9	12/4½
150,000	1	Ditto Cum. Pref. 7%	18/9		7	7	7 9 3		—	22/3	18/7½
1,075,167	5/–	Heenan Group	7/7½		10	20‡	6 11 3	7/7½	6/9	10/4½	6/9
142,045,750	Stk. (£1)	Imperial Chemical Industries ...	37/3	—1/4½	10	10	5 7 6	39/10½	37/3	46/6	36/3
33,708,769	Stk. (£1)	Ditto Cum. Pref. 5%	16/6	—6d.	5	5	6 1 3	17/1½	16/–	18/6	15/6
14,584,025	••	International Nickel	139	—2½	$3.75	$3.75	4 15 9	144	136½	222	130
430,000	5/–	Jenks (E. P.), Ltd.	15/4½	—1½d.	27½ ϕ	27½	8 19 0	15/7½	14/6	18/10½	15/1½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	15/–		5	5	6 13 3		—	17/–	14/6
3,987,435	1	Ditto Ord.	39/–	—6d.	10	9	5 2 6	41/3	39/–	58/9	40/–
600,000	10/–	Keith, Blackman	16/3		15	15	9 4 6	16/3	15/–	21/9	15/–
160,000	4/–	London Aluminium	3/9	—4½d.	10	5	10 13 3	4/3	3/9	6/9	3/6
2,400,000	1	London Elec. Wire & Smith's Ord....	40/9	—1/–	12½	12½	6 2 9	41/9	40/6	54/6	41/–
400,000	1	Ditto Pref.	22/9		7½	7½	6 11 9		—	25/3	21/9
765,012	1	McKechnie Brothers Ord.	35/–		15	15	8 11 6		—	48/9	37/6
1,530,024	1	Ditto A Ord.	32/6		15	15	9 4 6		—	47/6	36/–
1,108,268	5/–	Manganese Bronze & Brass	9/3		27½‡	25	7 8 9	9/6	9/–	21/10½	7/6
50,628	6/–	Ditto (7½% N.C. Pref.)	5/9		7½	7½	7 16 6		—	6/6	5/–
13,098,855	Stk. (£1)	Metal Box	42/6	—1/–	20‡	15M	4 14 0	43/9	41/9	59/–	40/3
415,760	Stk. (2/–)	Metal Traders	6/3		50	50	16 0 0	6/6	6/3	8/–	6/3
160,000	1	Mint (The) Birmingham	22/9		10	10	8 15 9	22/9	22/9	25/–	21/6
80,000	5	Ditto Pref. 6%	83/6		6	6	7 3 9		—	90/6	83/6
3,064,930	Stk. (£1)	Morgan Crucible A	34/6	—1/–	10	11	5 16 0	36/6	34/6	54/–	35/–
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	17/3		5½	5½	6 7 6	17/3	17/–	19/3	16/–
2,200,000	Stk. (£1)	Murex	55/–		20	20	7 5 6	57/6	54/10½	79/9	57/–
468,000	5/–	Ratcliffs (Great Bridge)	7/–		10	10	7 2 9	7/–	6/10½	8/–	6/10½
234,960	10/–	Sanderson Bros. & Newbould ...	27/–		27½D	27½	6 15 9	27/–	26/–	41/–	24/9
1,365,000	Stk. (5/–)	Serck Radiators	11/4½	—3d.	17½Z	15	5 3 0	12/–	11/1½	18/10½	11/6
600,400	Stk. (£1)	Stone (J.) & Co. (Holdings)	43/9		16	16	7 6 6		—	57/6	43/9
600,000	1	Ditto Cum. Pref. 6½%	20/–		6½	6½	6 10 0		—	21/9	18/9
14,494,862	Stk. (£1)	Tube Investments Ord.	48/6	—1/6	15	15	6 3 9	53/9	48/6	70/9	50/6
41,000,000	Stk. (£1)	Vickers	30/1½	—3d.	10	10	6 12 9	31/–	29/4½	46/–	29/–
750,000	Stk. (£1)	Ditto Pref. 5%	15/6	+6d.	5	5	6 9 0	15/6	14/9	18/–	14/–
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	23/–	+6d.	•5	•5	6 14 3A	23/–	21/3	24/9	20/7½
2,200,000	1	Ward (Thos. W.), Ord.	73/–	—6d.	20	15	5 9 6	73/6	70/9	83/–	64/–
2,666,034	Stk. (£1)	Westinghouse Brake	36/3		10	18P	5 10 3	36/3	32/6	85/–	29/1½
225,000	2/–	Wolverhampton Die-Casting ...	7/6		25	40	6 13 3	7/9	7/2½	10/1½	7/–
591,000	5/–	Wolverhampton Metal	15/3		27½	27½	9 0 3	15/6	14/9	22/3	14/9
78,465	2/6	Wright, Bindley & Gell	3/7½	—1½d.	20	17½E	13 15 9	3/9½	3/7½	3/9	2/7½
124,140	1	Ditto Cum. Pref. 6%	11/6		6	6	10 8 9		—	12/6	11/3
150,000	1/–	Zinc Alloy Rust Proof	3/–	—1½d.	40D	33½	8 17 9	3/1½	2/7½	5/–	2/9

•Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. ••Shares of no Par Value. ‡ and 100% Capitalized issue. • The figures given relate to the issue quoted in the third column. A Calculated on £7 14 6 gross. H and 200% capitalized issue. M and 10% capitalized issue. Y Calculated on 11½% dividend. ||Adjusted to allow for capitalization issue. E for 15 months. P and 100% capitalized issue, also "rights" issue of 2 new shares at 35/– per share or £3 stock held. D and 50% capitalized issue. Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. ϕ And proposed 100% capitalized issue. X Calculated on 17½%.